FEB 16 1923
Medical Lib.

SERIES 3—Vol. 6, No. 2 FEBRUARY, 1923

AMERICAN JOURNAL OF OPHTHALMOLOGY

Incorporating Established by
THE AMERICAN JOURNAL OF OPHTHALMOLOGY.....Adolph Alt 1884
THE OPHTHALMIC RECORD.....Giles C. Savage 1891
ANNALS OF OPHTHALMOLOGY.....James Pleasant Parker 1892
ANALES DE OFTALMOLOGIA.....M. Uribe-Troncoso 1898
OPHTHALMOLOGY.....Harry Vanderbilt Würdemann 1904
OPHTHALMIC YEAR BOOK AND LITERATURE.....Edward Jackson 1904-11

EDITORIAL STAFF

EDWARD JACKSON, Editor
CLARENCE LOEB, Associate Editor
M. URIBE-TRONCOSO
CASEY A. WOOD
MEYER WIENER
HARRY V. WÜRDEMANN

COLLABORATORS

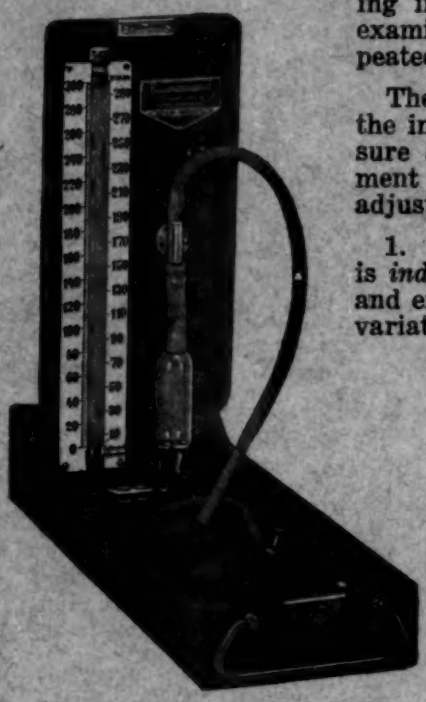
Frank Allport, *Chicago;* Hugo W. Aufmwasser, *Denver;* Hans Barkan, *San Francisco;* Arthur J. Bedell, *Albany;* Edmond E. Blaauw, *Buffalo;* Melville Black, *Denver;* Nelson M. Black, *Milwaukee;* Frank E. Brawley, *Chicago;* W. E. Bruner, *Cleveland;* Burton Chance, *Philadelphia;* Wm. H. Crisp, *Denver;* W. T. Davis, *Washington, D. C.;* George S. Derby, *Boston;* Alexander Duane, *New York;* Edward C. Ellett, *Memphis;* Marcus Feingold, *New Orleans;* Wm. C. Finnoff, *Denver;* M. W. Frederick, *San Francisco;* Harold Gifford, *Omaha;* Sanford R. Gifford, *Omaha;* Harry S. Gradle, *Chicago;* John Green, Jr., *St. Louis;* D. F. Harbridge, *Phoenix, Ariz.;* Wm. F. Hardy, *St. Louis;* Gustavus I. Hogue, *Milwaukee;* Thomas B. Holloway, *Philadelphia;* John A. McCaw, *Denver;* Charles H. May, *New York;* Wm. R. Murray, *Minneapolis;* Walter R. Parker, *Detroit;* Giles C. Savage, *Nashville;* F. Mayo Schneideman, *Philadelphia;* Theodore B. Schneideman, *Philadelphia;* George E. de Schweinitz, *Philadelphia;* T. H. Shastid, *Superior, Wis.;* Charles P. Small, *Chicago;* A. C. Snell, *Rochester, N. Y.;* George W. Swift, *Seattle;* D. L. Tilderquist, *Duluth;* Will Walter, *Chicago;* John E. Weeks, *New York;* Wm. Zentmayer, *Philadelphia;* Charles Zimmermann, *Milwaukee. Foreign:* Sir James W. Barrett, *Melbourne, Australia;* Marcel Danis, *Brussels, Belgium;* Enrique B. Demaria, *Buenos Aires, Argentina;* Robert Henry Elliot, *London, England;* Julius Fejer *Budapest, Hungary;* J. Santos Fernandez *and* F. M. Fernandez, *Havana Cuba;* J. de J. Gonzalez, *Leon, Mexico;* H. J. Howard, *Peking, China;* M. Landolt, *Paris, France;* J. Komoto, *Tokyo, Japan;* Arthur F. MacCallan, *Cairo, Egypt;* F. P. Maynard, *Crewe, England;* E. E. Montaño, *Mexico City;* Speciale Cirincione, *Rome, Italy;* Frederick C. Tooke, *Montreal, Canada.*

Annual Subscription Ten Dollars in Advance.
Single Copies One Dollar.

Published Monthly by The Ophthalmic Publishing Company
7 West Madison Street, Chicago, Illinois.

Entered as Second Class Matter January 1st, 1918, at the Post Office, Chicago, Ill., under the act of March 3rd, 1879.

Why the Baumanometer



The importance of blood pressure testing in connection with ophthalmological examination has been emphasized repeatedly.

The Baumanometer illustrated here is the instrument for taking the blood pressure accurately and easily. This instrument has no moving parts to wear or misadjust.

1. Because each Baumanometer scale is *individually calibrated,* thus definitely and exactly compensating for unavoidable variations in the glass tubing.

2. Because this scientific principle of *individual calibration* so carefully carried out in construction is insured in practice by automatic functioning, which compels uniform usage of the instrument.

a. No sliding scale to adjust.

b. No air-pockets to shake out of the mercury column.

c. No moving parts to wear or misadjust.

d. No valves to regulate or leak.

e. One-piece mercury tube.

f. Fewest number of parts and sheer simplicity of design.

Because it is safe, portable, attractive and efficient.

Desk Model Baumanometer . . . . . $32.00 less 2%

Write now for 32 Page Booklet. Free on request.

RIGGS OPTICAL COMPANY

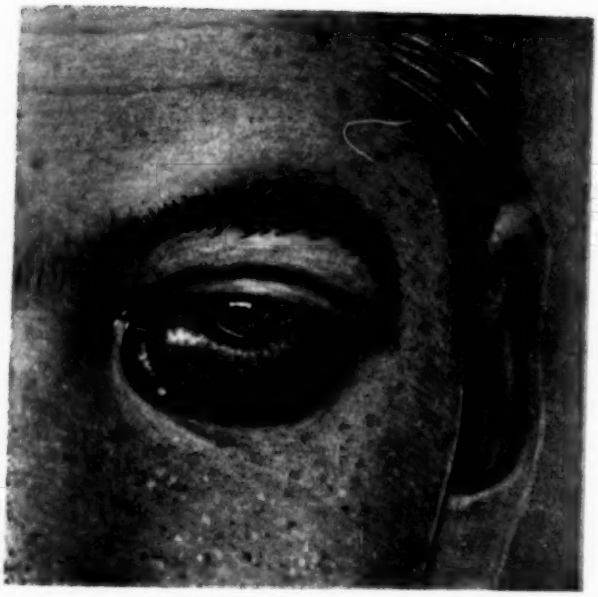
Exclusively Wholesale

OMAHA
SIOUX CITY
LINCOLN
QUINCY
WICHITA
MADISON, WISC.
KANSAS CITY

SAN FRANCISCO
OKLAHOMA CITY
CEDAR RAPIDS
SIOUX FALLS
HASTINGS
DENVER

PORTLAND
SPOKANE
HELENA
FARGO
MANKATO
POCATELLO

SEATTLE
TACOMA
OGDEN
BOISE
SALT LAKE CITY
PUEBLO
WATERLOO



PULSATING EXOPHTHALMOS. (WHITHAM'S CASE 1)

AMERICAN JOURNAL OF OPHTHALMOLOGY

Vol. 6 FEBRUARY, 1923 No. 2

PULSATING EXOPHTHALMOS.

LLOYD B. WHITHAM, M.D.

BALTIMORE, MD.

Seven cases, four traumatic and three spontaneous, observed by the writer and his colleagues, are here reported. In most of them ligation of the internal carotid was practised, and to a large extent proved its value as a remedy. In several cases rather long time elapsed before the operation was done. All were helped by it. Case 1 is illustrated in Color Plate II.

The following seven instances of this relatively rare affection are here presented for the first time, each having been carefully followed over a long period and presenting an individual and interesting picture:

CASE 1. (Author's). *Traumatic.* G. F. B., single, aged 30 yrs., occupation waggoner, was first seen by the writer on July 11th, 1918. Previous medical history negative save for scarlet fever in childhood and gonorrheal urethritis 5 yrs. ago. On June 3, 1918, while riding a mule, he collided with a rapidly oncoming motorcycle, and was either struck or kicked over the right, anterior, temporal region; inflicting a deep gash in the flesh and causing a linear fracture of the frontal bone just below the supraorbital ridge, with involvement of the outer table only.

At this time he was brought into the hospital unconscious, with Cheyne-Stokes breathing and "partial right sided paralysis" and was immediately operated upon, the surgeon making a trephine opening in the skull and noting that the inner table had not been fractured, and that the pressure and pulsation were normal.

For three weeks the patient was unconscious. A "right sided facial paralysis and flaccidity of the right arm and leg" were remarked, and the man reported in a "very bad condition." The daily notes chronicled an interesting convalescence: "Restless, unconscious, pulse 60, difficulty in taking fluids or food, voids involuntarily," while the paralysis was reported to have "cleared up before consciousness returned," tho decided mental sluggishness persisted. Examination, made by the resident physician at this time, showed "paralysis of the third nerve of the left eye and slight papillitis," the right eye being normal. Two weeks after the accident, they noticed that the "paralysis of the right arm and leg was gone," but that he was still "dazed and unable to respond to questioning."

Ptosis and exophthalmos of the left eye were now recorded for the first time, and the case turned over to the writer on July 11th, 1918, the following being the patient's condition on that date: *Right eye:* Slight congestion of the superior and inferior palpebral conjunctiva, vision 20/30 ++; otherwise eye perfectly normal. *Left eye:* Marked exophthalmos, great engorgement of the palpebral and bulbar conjunctiva; extensive chemosis, particularly inferiorly; lagophthalmos and haziness of the corneal epithelium; definite restriction in the movements of the globe; pupillary reactions normal; vision 20/60.

Ophthalmoscopy: Right eye: negative. Left eye: Retinal veins dark and distended. Disc margins a trifle blurred. Fundus noted as physiologic despite the slight veiling of all details owing to the dryness and haziness of the exposed corneal epithelium.

Perimetry, urinalysis and Wassermann negative. Dental and laryngologic consultations fruitless. Left eye pulsates to palpation, and a distinct blowing murmur is heard with the stethoscope over the temporal region.

X-ray: Right frontal bone shows an area of increased radiability, due to re-

moval of bone from that area. The frontal, sphenoid, ethmoid and maxillary sinuses are clear. There is no Roentgen evidence of change in the region of the sella. *Linear fracture nasal side, superior border of left orbit.*

August 23rd, 1918: Working with a general surgeon, Dr. Stone, an exploratory operation of the anterior portion of the orbit was performed, but no vessels specifically worthy of ligation were found, a general passive congestion being noted.

While testing the patient's vision, it was evident that he could read some letters, tho small, with ease, whereas others, even of the largest size, he could not name. However, he could draw an exact copy of the missed letters as well as assure the examiner that he knew and could see the letters very well, but could not name certain of them. Moreover, he showed his diary, which he had been keeping up during his convalescence, and demonstrated that he could write perfectly what *originated* in his mind, but could neither read it aloud nor write perfectly from dictation. For instance: the examiner asked him to write "Base Hospital" and he wrote, instead, "Tase Hospital;" again, he was told to write "this is a fine day," but spelled "day" "fay" instead. Because of this latter mental confusion, a neurologist, Dr. Casamajor, was called in.

The writer, backed by Dr. Greenwood, in consultation, made the diagnosis of arteriovenous aneurism, traumatic in origin and probably of the internal carotid artery and cavernous sinus, and suggested pressure bandage and compresses to the eye, as well as pressure over the left common carotid; and, should these measures fail to bring about an improvement, advised that the left internal carotid be ligated. On September 23rd, this was done and, by October 4th considerable progress in the subsidence of the symptoms was noted; the vision in the proptosed eye had greatly improved, and the exophthalmos was almost gone. The author did not see the man after his operation; but has kept in touch with his surgeon, and a number of subsequent letters from him recounted even greater improvement, tho his mental sluggishness still persisted.

Last year he wrote that he had been obliged to give up his new position as an automobile mechanic, owing to the fact that the necessitated crawling under cars, assumption of stooping postures and heavy lifting produced subjective and objective disturbances, but that he was then happily situated in a less laborious occupation.

Under date of February 19th, 1922, the patient reported that, while old symptoms have been greatly lessened, he still has a ringing sound in his head, occasionally being able to hear the pulsations. His eye is sometimes bloodshot, tho usually clear; excessive glare produces slight lacrimation; he still notices difficulty in grasping the meaning of words in reading, soon losing interest in the text; while he hesitates considerably in speaking, in order to think of the right word; and any laborious work, such as lifting or prolonged stooping, causes his heart to miss beats and his eye to bulge a little more. Otherwise he says he is much improved, and asserts that he is a better man than he was before the accident.

Fig. 1. Pulsating exophthalmos, March, 1922, three and one-half years after ligation of internal carotid. Case I.

Again, under date of April 14th, 1922, he writes that Dr. Grant of San Diego has just examined his eyes and found

them both normal, with the following correction in each: + 0.75 sph. ⌒ + 0.50 cyl. ax. 180°, the only difference being that the retinal veins of the left eye are engorged.

Several points stand out in this case and make it of no little interest. First, the length of time between the onset of the symptoms and the ligation of the artery; a wait which, tho imperative, seemed to preclude the possibility of even saving the eye itself. The chance of restoration of vision was so doubtful that it was hardly taken into consideration. Second, the terrific reaction of the ocular tissues before operation and the remarkable restitution to normal following operation. Third, the safety of ligation of the internal carotid in the presence of aphasia, a condition which is dreaded as a sequel of the operation itself. Certainly this patient's history leads us to feel that a ligation of the internal carotid may be undertaken with hope of success in the most desperate cases.

Case 2. (Dr. J. W. Downey's). *Traumatic:* W. E. C., male, white, age 49, was seriously injured in a street car accident May 4, 1919. He was immediately brought to the hospital, and admitted under the surgical service of Dr. Walter D. Wise. The man was unconscious, but the only head injury that could be made out was a superficial scalp wound in the right frontoparietal region. There was no bleeding from the mouth, nose, or ears. The man remained in a semiconscious state for several days, with increasing evidence of brain injury, and on May 10th Dr. J. W. Downey, Jr., was asked to examine his eyes.

The ocular examination at that time showed nothing of diagnostic significance. Both eyeballs were rather prominent and slightly congested. Ocular movements were apparently normal in all directions. Pupils normal. Eyegrounds normal. On May 12th the patient developed convulsions and other symptoms pointing to an intracranial lesion of the left side, and a left subtemporal decompression was done by Dr. Wise, which revealed an extradural and subdural hemorrhage and brain lacerations.

Following the operation, the man regained consciousness but exhibited a marked aphasia. Several days later he complained of the left eye, and another examination was made by Dr. Downey, who reported definite exophthalmos of the left eye, with moderate conjunctival chemosis and dilatation of the retinal veins. Auscultation disclosed a typical bruit over the eyeball. There was no doubt that the condition was an arteriovenous aneurysm, but owing to the serious general condition of the patient, only palliative treatment could be attempted.

The eye symptoms continued to increase rapidly, the eyeball becoming markedly proptosed until the lids were stretched wide apart. The conjunctiva became violently congested and ulcerated, the cornea markedly steamy, and the media so cloudy that ophthalmoscopy was impossible. The bruit could be heard all over the left side of the face and neck. Ligation of the internal carotid artery seemed to give the only hope of recovery, but had to be deferred on account of the general condition of the patient, and of course, seemed especially dangerous in view of the aphasia.

On July 12th, 1919, over six weeks after the initial symptoms of pulsating exophthalmos had arisen, the internal carotid artery was ligated by Dr. Wise. There were no untoward symptoms from the procedure; on the other hand, improvement was rapid and marked, and the patient was discharged from the hospital Sept. 4th, 1919, with the eye normal in appearance. No complete eye examination was made at the time of the patient's discharge from the hospital, as Dr. Downey was out of the city.

The man returned to his home in Memphis, Tenn., and did not report to Dr. Downey until June 7th, 1921, over two years after his injury. Examination of the eyes at this time showed vision to be 20/30 partly. No exophthalmos, no bruit. Cornea clear, pupil normal. Eyegrounds normal, except for a fullness of the retinal veins, which was also present in the other eye. Field of vision normal. The man's general condition was normal, and he had fully recovered from his aphasia except "a bad memory for names."

CASE 3. (Dr. H. K. Fleck's). *Spontaneous.* On June 15, 1921, Mrs. W. P. T., age 26, because of some edema of the lids, was referred by Dr. F. K. Nichols. The patient had given birth to a healthy child 13 days previously. She had been confined to her bed the four weeks prior to the delivery because of high blood pressure. At the time of confinement pressure was 140. Urine showed a small amount of albumin.

At the time of examination there was some edema of the lids of both eyes, and a slight redness of the left conjunctiva. Neither the edema nor the redness of the conjunctiva was sufficient to attract much attention. Pupils, corneae, fundi, and motility normal. Vision right 20/20, left 20/40, unimproved by glasses. There was a history of a left convergent strabismus as a child.

June 22: An increase of the edema of the lids of the *left* eye, and a definite congestion and edema of the conjunctiva and subconjunctival tissues. Cornea, pupil and fundus normal. External rectus is completely paralyzed. There is no diplopia because of the eye being amblyopic. Vision 20/30 imperfectly. There is a definite exophthalmos, and on placing the hand on the globe a definite pulsation is noted. With a stethoscope on the globe a loud bruit is heard. This bruit is also heard over the entire side of the face, and along the large vessels of the neck, but loudest along the ascending ramus of the inferior maxilla. The bruit could be stopped by pressure on the left internal carotid.

On going into the history, it was learned, that about ten days before the baby was born, and while in bed, she had severe pain in the forehead which came on rather suddenly, and was soon accompanied by great noise, blowing in character. The patient stated that she did not for a time associate the noise with her pain, in fact, thought it came from the trains on a nearby railroad. The pain subsided in a few days, and the noise decreased, so that at the first examination nothing was said about it, and it was only mentioned at the second examination, when she was asked if there was any tinnitus.

During her stay in the hospital, the blood pressure varied from 130 to 150, averaging about 140. Her confinement and convalescence were uneventful, the child being her first.

After discussion with her physician, ligation of the left internal carotid was advised. A second consultation was requested; diagnosis and proposed treatment were concurred in. Entered the hospital a second time June 27, 1921. Urinary analysis showed a trace of albumin; few casts. Blood pressure 130, Wassermann and other laboratory results negative.

Operation June 29, 1921, by Dr. F. K. Nichols and Dr. George Stewart. *Internal carotid exposed,* and a piece of 1/4 inch tape passed around the artery. Clamping the artery sufficiently to stop circulation immediately stopped the bruit. The stethoscope was kept on the eye and the clamp released; the bruit recurred, but was lost again when the tape was tied.

Immediately on regaining consciousness, the patient stated that the noise had completely ceased. Convalescence was uneventful. There was no cerebral disturbances from the tying of the carotid.

July 6. Is comfortable, paralysis of external rectus is unchanged. Edema of lids and redness of conjunctiva less; exophthalmos less. Can make out no difference in the fullness of the veins or arteries in the retinae.

July 13. Still some exophthalmos; paralysis of external rectus unchanged. With the stethoscope on the eye, can get a very distant faint bruit. This bruit causes no tinnitus. Patient is comfortable and has no annoyance from the operation other than a small dressing on the neck.

March 20, 1922. Dr. Nichols reports the eyes as normal.

CASE 4. (Dr. C. A. Clapp's). *Traumatic.* C. M., white, female. Sept. 26, 1919. An automobile accident about four weeks ago resulted in bruising right side of face, which was followed about one week later with swelling of left eye. Family history and previous medical history negative. Left eye is proptosed, marked edema of bulbar conjunctiva and very limited movement in all directions. Pupil normal in size and reaction.

Ophthalmoscopic Examination: Pupil dilated, fundus showed fullness of

optic nerve with veins full and tortuous. Vision 20/20 in right eye and 20/30 in left eye. Stethoscope revealed marked bruit over eye, extending over temple to occiput.

October 3, 1919. Eyes show increased size of episcleral vessels, with more involvement of external rectus than other muscles.

October 6, 1919. X-ray of sinuses was negative. Patient entered hospital in same condition. Pulsation can be easily felt on palpation of eye. Urine examination was negative.

October 20, 1919. Under ether, Dr. James Lumpkin *ligated left internal carotid* with heavy silk at 11 a. m. Bruit ceased almost at once. Patient left the hospital quite comfortable with eye receding and no complaint.

October 31, 1919. Returned to dispensary with eye still receding, vision of left 20/70.

November 7, 1919. Patient returned complaining of some pain and pulsation in head.

CASE 5. (Dr. C. A. Clapp's). *Traumatic.* R. H., white, male, aged 45 yrs., came to Johns Hopkins Hospital on May 19, 1921, and gave the following history: General health excellent. About seven weeks ago was struck on jaw with handle of a wagon jack. This was followed by some diplopia. Three weeks ago patient found left eye was greatly swollen upon awakening in the morning, which has been followed by considerable pain, so great as to prevent sleep. Consulted several physicians and some oculists, who prescribed drops and hot compresses. V—R. 20/30; L. 6/200.

Examination: Right eye normal. Left eye shows both upper and lower lids swollen and edematous, moderate proptosis (3 mm.). Bulbar conjunctiva edematous with vessels dilated. There was no movement of eye in any direction. Pupil reacts to both light and convergence. Palpation results in well marked thrill. Auscultation reveals a continuous murmur accentuated in systole. Ophthalmoscopic examination showed slight edema of the retina with slight dilatation of vessels. Diagnosis: Pulsating exophthalmos, probably arteriovenous aneurism with ophthalmoplegia externa.

Patient was admitted to hospital May 20, 1921 and operated upon May 24 by Dr. Reid, who ligated external carotid and applied metal band (Halsted) on common carotid.

Subjective symptoms rapidly grew less, the eye gradually receded, and patient was discharged June 10, 1921, as well.

CASE 6. (Dr. C. A. Clapp's). *Spontaneous.* T. W. Q., white, female, married, aged 36 yrs.

March 17, 1918. History: Two weeks ago, while still in bed recovering from a miscarriage, suddenly felt a rush of blood to the head, followed by drooping of the upper lid and diplopia. This condition had remained nearly stationary since then. Family history and previous medical history negative.

Examination: Right eye normal. Left eye shows normal pupillary reactions, but upper lid droops and eye is turned in toward nose, with inability to move eye upward or outward. Diagnosis: Paralysis of sixth with branches of third going to superior rectus and levator palpebrarum. Wassermann was negative, and general survey failed to find a lesion. For three weeks there was no visible change in condition.

Patient returned on June 4th, or about two months after the last visit, stating that two weeks ago she had a peculiar sensation in left upper lid, as if some obstruction had passed, traveling across side of face and down by ear; this was followed by gradual swelling of lids and redness of eye and pulsating tinnitus. Examination at this time showed the same paralytic condition as of previous date, but with a proptosis of the left eye of 7 mm. Veins of lids much engorged, with marked edema of bulbar conjunctiva. Slight pressure of fingers easily detects a thrill, while the stethoscope reveals a loud bruit extending from eye to ear and down the neck to thyroid cartilage. Pressure on carotid causes cessation of bruit. Tension of eye slightly full. Ophthalmoscope showed engorged veins but no pulsation.

Diagnosis: Pulsating exophthalmos probably due to arteriovenous aneurysm.

Patient was advised to have ligation of carotid; but the surgeon she consulted advised against the procedure, but ordered her to bed. Under this line of

treatment there was slight reduction of the subjective symptoms of tinnitus, but no change objectively. Patient contracted influenza in the fall and died after a brief illness, no change having taken place in the eye condition.

CASE 7. (Dr. Hiram Woods). *Spontaneous.* July, 1915. Male, white, farmer, aged 58 years.

The abnormal position of the eye had been noticed for a month or so, and no trauma was recollected. There was left exophthalmos of about 3 or 4 mm. The displacement of the globe was somewhat toward the median line. There was a partial ptosis. The external rectus was capable of abducting the eye only about half way to the external canthus. The conjunctiva was edematous, and the veins of the ocular portion distended. Vision was 20/30 and could not be improved. The field, to the finger test, seemed normal. Media were clear. The papilla showed a very deep physiologic pit, reaching the border of the nerve. The man's complaint was that he had the deformity, about which he seemed very sensitive, and that there was diplopia to the left side. He also had defective hearing, more marked on the left side.

November, 1915. The appearances of the patient were practically identical, save that the paralysis of the left externus was complete. Central vision in the left eye had fallen to 20/70. As before, the right eye was normal in appearance and visual acuity. The fields were normal in the right and contracted, directly outward, about 30°, in the left eye. He had another symptom—tinnitus in the left ear. Tuning forks showed normal low limit, and the Galton whistle, normal high tones. Bone conduction was defective on both sides, and Weber's test with 512 fork on nose or skull was referred to right ear. The watch was heard only on contact with each ear. I could make out no bruit or pulsation at that time. Thus, in three months an externus paralysis had become complete, and left tinnitus had developed. Possibly the engorgement of the ocular conjunctival veins was somewhat more marked. Examination of the sinuses by Dr. Richard H. Johnson was negative. The man could not be induced to consult a surgeon. He was taking KI and thought it helped the tinnitus.

He went home, but returned to Baltimore after three months, i. e., February, 1916. The eye appearances were unchanged, pulsation could not be felt, even on deep pressure, and there was no suspicion of a bruit, even with the stethoscope. The left ear was totally deaf to voice, tuning forks, Galton whistle or watch. The optic papilla showed nothing abnormal. There was no pain. Vision, in the left eye was unchanged—20/70. He was at the University Hospital for a fortnight. Roentgen ray examination was negative, as was the blood Wassermann. While in the hospital pulsation was detected for the first time. It was feeble and could be felt only on deep pressure of the eyeball backward.

Thus, nearly eight months after the exophthalmos was first noticed, there had developed total externus paralysis, defective vision, complete left deafness, and, only toward the close of the period named, pulsation on pressure and a bruit. He now consented to an examination by the late Dr. Frank Martin. After study of the case, Dr. Martin advised ligation of the internal carotid. The man went home, and after talking it over with his family, refused operation.

He was next seen in August, 1916. Conditions were the same, save that the bruit could be heard without stethoscope by applying the ear to any part of the left skull. Pressure on the carotid lessened and sometimes stopped the bruit. Pulsation could be elicited on pressure. It was synchronous with the radial pulse. At this writing, as stated above, the man is alive, doing moderate farm work, and the condition is unchanged after nearly seven years since the exophthalmos appeared.

GENERAL REMARKS.

Probably the most thoro and elaborate résumé of this subject was instituted by the father of the present Sattler, in 1880, and completed by his son in the "Handbuch" of last year. The most complete compilation upon this

condition, originating in our country, is the one hundred and twenty page monograph of de Schweinitz and Holloway, written fifteen years ago, taking up the intimate analysis of sixty-nine cases, not recorded prior to 1907, and studying them in relation to the three hundred and thirteen total cases noted in the medical literature from the time of the first reported one, one hundred and two years before.

This brochure sets forth the writers' objects as follows: 1. To analyze those cases not previously recorded in tabular statements already referred to. 2. To elaborate and compare the therapeutic measures, surgical and otherwise, which have been employed in their treatment. 3. To endeavor to determine, from the analyses, those surgical procedures which seem likely to prove of the greatest advantage in the control of the symptoms of this disease.

Historically, the lesion was first technically described by Travers, in 1805, while the first anatomic examination was performed by Barron thirty years later, tho Rivington was the pioneer in demonstrating the intracranial origin of the disease. Since this time, but three hundred odd cases have been recorded, attesting the comparative rarity of the affection.

The condition, known, variously, as pulsating exophthalmos, aneurismal proptosis and vascular protrusion of the eye, may be due to a number of lesions, both extra- and intraorbital; exceedingly vascular orbital tumors, angiomas, sarcomas, encephalitis, true aneurism of the ophthalmic artery, aneurism of the internal carotid artery, varicose dilatation of the orbital veins, local arteriovenous communication, or communication between the internal carotid artery and the cavernous sinus, the last being by far, the most frequent cause. Thus the disease is usually of intracranial origin, the orbital manifestations being purely secondary and dependent upon venous obstruction. Keller contends that the name pulsating exophthalmos should be applied only to that disease in which there is a definite opening between the internal carotid artery and the cavernous sinus, being supported in this view by de Schweinitz and Holloway.

As a matter of fact, in a series of nineteen autopsies, Frost discovered three with orbital aneurism, two with affection of the cavernous sinus, two with aneurism of the intraorbital portion of the ophthalmic artery, four with condition undetermined and eight with arteriovenous communication.

The disease may be spontaneous, of which variety interesting cases have been reported by Noyes, Friedenwald, Wolff, Knapp, Ruttin and others, this type occurring most frequently in women. However, the affection is of traumatic origin in 71%, a higher rate than recorded for the first three hundred and thirteen cases, and, as such, is observed in men in 75%, more commonly between the ages of thirty and fifty years.

Clinically, it is unrecognized, as a rule, for some time after receipt of causative wound, the author's case displaying an interval of two weeks, while Erggelet has lately written of a patient who developed the condition 31 months after the causative injury. From the obstruction of the venous outflow, there is at first marked distention of the veins, but later the arteries become atrophic and the blood flows from the carotid thru the cavernous sinus and into the veins of the eye and lid, a reversed current, at which time pulsation synchronously commences.

Proptosis, pulsation, thrill, objective and subjective noises and vertigo are the cardinal signs of a fullfledged case, one eye, only, being involved, tho exceptionally both are affected, if not directly, at a later date. The exophthalmos can be reduced by digital pressure, but the globe at once returns to its abnormal position as soon as the pressure is released. If the exophthalmos is unilateral, or more pronounced on one side than the other, annoying diplopia is complained of.

Pulsation, present in 90% of patients, is synchronous with the heart beats, is visible, can be distinctly felt by palpating the closed lids and becomes more pronounced when the eyeball is pushed backward into its socket. The bulbar conjunctiva becomes chemosed and congested.

While palpation does not cause discomfort, the patient, as rule, complains

of a severe pain behind the involved eye immediately upon recovering from the first effects of the accident, which is accompanied by a whizzing noise in the head, like the sound of rushing water, sometimes so loud and constant as to interfere with sleep. This is increased by stooping or lying down, but ceases when the blood supply is compressed on that side. Auscultation over the lids elicits a loud, blowing murmur, the sound being conducted to the bones of the skull for a considerable distance from the eye.

After the bruit, pulsation and proptosis have existed for several months, the superior and inferior ophthalmic veins, at the upper and inner aspect of the orbit, present tortuous enlargements. The venous masses are quite characteristic: rounded, soft, easily compressible, painless and communicating a distinct thrill and pulsation when palpated.

It is possible for vision to be lost from optic neuritis and atrophy, retinal hemorrhages, glaucoma and cataract, tho it may be unaffected thruout; the ophthalmoscope, however, always shows the retinal veins in the affected eye larger and more tortuous than those of its fellow. De Schweinitz and Holloway believed the vision more frequently impaired, and that complete blindness often results, tho Maitland Ramsay holds the opposite view.

It is not unusual to observe an immobility of the eye outward, from palsy of the abducens nerve, which passes by the cavernous sinus. The first twig of the trigeminus may be affected, for the same anatomic reason, and produce corneal disturbances of a trophic nature—dryness and insensitiveness, neuroparalytic keratitis—while, owing to the widening of the palpebral fissure and consequent exposure of the globe, unnoticed impaction of foreign particles upon the cornea with resultant ulceration, may occur. The third nerve, also, may be affected, as in the author's case. As a matter of fact, cranial nerve involvement is an important point in differential diagnosis, as will be seen in a moment.

Pulsating exophthalmos should be differentiated from exophthalmos intermittens due to hypoplasia of the jugular vein, from the proptosis of Graves' disease, orbital tumors, cellulitis or phlegmon, ethmoidal mucocele, rachitic deformity of the skull and osteoporosis. The differential diagnosis of a rupture of the internal carotid from an aneurism of the ophthalmic artery may fairly certainly be made, as in the former there is paralysis of the nerves, especially the abducens, while in the latter the vision is much affected owing to the orbital location of the lesion.

Treatment.—A few instances of spontaneous healing are on record, and it is quite likely that the cures cited by Gasparri, from the instillation of adrenalin and the administration of potassium iodid, could be classed under this heading with those of Oliver, Pincus and Starkey. Cases of improvement under a medical regimen are reported, also, by Evans, Thierry and Punzo. Of seven untreated cases, two became better, two grew worse and three died.

While compression of the common carotid on the side of the lesion, pressure bandage over the proptosed globe and full doses of potassium iodid and coagulose may be tried for a while, there is little likelihood of success, digital compression, according to Reuchlin, yielding 22.1% cured or improved, tho other recorders differ from this. For example, of thirty-seven cases, treated by compression, three were completely cured, six partially cured, one suddenly died and the remainder manifested no change. Nevertheless, this method still finds favor with several eminent oculists, among them Key, whose results have been moderately gratifying.

Latterly, gelatin injections have been found efficacious by some, notably Lebon, Santos-Fernandez, Beauvais, Zentmayer, Bedell and Kaz, who have reported cures, the first mentioned gentleman even when previously undertaken operative procedures had been unavailing. De Schweinitz and Kaz believe that this method should be employed before more radical interference is undertaken, while von Nagy reviewed seven cases yielding fairly good results under this treatment.

A combination of Zentmayer's and Bedell's four cases shows cure in 50%, improvement in 25% and failure in 25%. Tho gelatin injections have been tried in but a few instances, yet the results have

been so encouraging as to amply justify their use, provided, of course, the patient is seen early.

However, the knife must, usually, be resorted to, and the chief operative procedures are as follows:

1. Ligation of common carotid artery on the affected side.
2. Ligation of both common carotids.
3. Ligation of the internal carotid on affected side.
4. Ligation of both internal and external carotids on same side.
5. Ligation of the common, external carotid and superior thyroid arteries on one side.
6. Orbital operations. (a) Ligation of superior ophthalmic vein. (b) Ligation of pulsating veins at inner angle of the orbit with excision of the varices that are a common accompaniment of this condition.

Concerning the choice of these, however, there have been so many conflicting opinions, that it is well to review the later experiences of a few ophthalmologists of note:

Cauchoix has, only a short time ago, prepared a detailed tabulation of eighteen cases treated by ligation of the vessels, of which but 57.4% were cured. Of the six in which the *internal carotid was ligated* 66% were successful. In five, both the internal and common carotid were ligated, in ten both common carotids; in thirteen the vein was tied, the carotid artery having been ligated before in ten of them. He concludes by emphasizing the danger of bilateral ligation at the same time, and the advantages of tying the ophthalmic vein, the latter procedure being so frequently effectual that it deserves an important, if not predominant, place in the treatment of pulsating exophthalmos. He believes it to be so harmless that it should be tried in most cases.

The superior ophthalmic vein was ligated in seven, being exposed thru an incision at the base of the upper lid, tho one surgeon resected the outer wall of the orbit, a procedure felt to be unnecessary.

The first orbital vein operations were performed by Lansdowne, in 1873, and Noyes, in 1880, the latter ligating the inferior orbital vein and curing a spontaneous case of the affection thereby, a similar case and result being reported by Golovin in 1897, while three others tied the angular vein. In one individual, intense headache followed, with slowing of the pulse, ascribed to thrombosis in the cavernous sinus. In this connection, despite Zellar's warning that such a condition might produce pulmonary edema, no such complication has ever been observed.

As illustrative of the favorable possibilities of bilateral ligation of the carotid, despite the general aversion for the procedure, de Lapersonne, in a patient with fracture of the skull and pulsating exophthalmos supervening, two days later, accompanied by neuroparalytic keratitis, ptosis and intolerable subjective disturbances, recently ligated the common carotid on the affected side, with relief of all the symptoms but the subjective "chug-chug," the latter being ultimately dissipated by the ligation of the common carotid on the other side, after the vessel had been prepared by several weeks of training of the vertebral arteries in preparation for their substitution for the ligated artery. For this the carotid was cautiously compressed with the fingers, dizziness, jerking and profound asthenia at first ensuing for several hours. Finally, this could be borne comfortably for ten minutes at a time, so that a ligature was thrown around the vessel eight months after the first operation. For the first three days there was a feeling as of ice in the head, but this, and other symptoms, soon lessened. Twenty-two months later the patient still has frequent headaches, but is able to read and write without difficulty, tho stooping causes severe dizziness, and there is impairment of memory with early mental fatigue, a symptom de Lapersonne has remarked following another bilateral carotid ligation. He also reports a case occurring seven months after the causative wound, suddenly becoming aggravated and cured by carotid ligation.

Sattler, the younger, as well as de Lapersonne, also prefers ligation of the carotid which he believes usually sufficient and, with the scrupulous present day asepsis and technic, hardly dangerous to life. Of the orbital methods, he

favors the ligation and excision of the dilated orbital vein.

Contrary to this view, Buchtel believes that ligation of the common or internal carotid is serious and sometimes fatal, failing, in a large number of cases, to give more than temporary relief. He, with Kaz, thinks that ligation of the orbital veins is a most uniformly efficacious procedure and of little gravity, having proved successful even after ligation of the carotid had failed. Kaz, moreover, has collected thirty-six cases of one sided ligation of the carotid with but ten cures, improvement in fourteen, temporary improvement followed by relapse in eight, and death in three, all patients having been operated upon in the more recent days of aseptic surgery. He finds but five recorded cases in which the ophthalmic vein was ligated, all being successful, and believes this operation should be undertaken before the carotid is touched, the latter being reserved for cases wherein the brain symptoms prevail.

Von Nagy, summing up the salient features in one hundred and fifty-three cases, concludes that the orbital operations have given the best results (eighteen with but two failures), while the combined orbital and carotid operations gave two failures in eleven cases. In seventy-seven cases of carotid ligation, 58.44% gave healing or improvement, and 32.9% no result. He cites two patients in whom the carotid was compressed from two to four hours daily as a preparation for subsequent ligation, a good outcome being realized in both, the men now being at work. The compression, he contends, is only of use in this preparatory connection.

Zentmayer describes two patients of his own and twenty-seven others. Of these twenty-nine cases, the common carotid was ligated in sixteen, with a cure in seven, improvement in five and failure in four; both the common carotid and the ophthalmic vein were tied off in one case, a cure resulting; another case was cured by combined ligation of the common carotid and facial vein; another showed slight improvement after tying the orbital veins; slow ligation of the carotid in two cases yielded a cure in one and improvement in the other, while ligation of both carotids in one subject was a failure. A combination of Zentmayer's cases and Bedell's statistics reveals the following: Common carotid tied thirty-two times, with 37.5% cures, 37.5% improvements and 25% failures, tho without fatalities.

Ligation of ophthalmic vein performed in six cases, with 50% cures, 16% improvements and 33% failures.

Ginsberg reckons that, while ligation of the carotid renders a fair proportion of good results, 64.5% more or less completely relieved, it is not without danger to life if not later cerebral disturbances. The average number of deaths is 9.9%, higher in cases where ligature has been applied on both sides.

Warbasse asserts that, while tying the internal carotid in the neck can be expected to give improvement but not cure, because of the collateral circulation in the Circle of Willis, yet ligation of the common, instead of the internal, carotid has added much to the danger of softening of the brain and little to the expectation of cure, whereas ligation of both internal carotids has been attended with high mortality. He thinks that the vessels near the disease should be attacked before ligation of the opposite carotid is attempted.

De Schweinitz and Holloway give ligation of the common carotid a record of improvement or cure in 50%, recurrence in 20.5%, negative results in 17.6% and deaths in 11.7%, while in two cases of double ligation of the common carotid, one suffered complete recurrence within a month after the first ligation, dying five days after the second ligation, and the other showed no result after the first ligation but distinct improvement after the second one sixteen months later. They predict fewer ligations of the common carotid and a more general use of ligation of the superior ophthalmic vein because of its uniformly good results, suggesting that this procedure should be considered before ligating the carotid, and certainly should precede ligation of the second carotid provided the first operation has failed.

Reuchlin, in one hundred and sixteen cases, showed, from ligation of the common carotid, improvement or cure in

68.8%, negative results in 21.5% and deaths in 9.5%.

Fuchs advocates ligation of the carotid as giving the greatest chance of success, secondarily recommending direct ligation of the dilated veins of the orbit in some cases.

The best orbital operation is ligation of the superior ophthalmic vein, based on the principle that stopping the efferent vessel from an aneurismal varix has the same general effect as blocking the afferent. While the orbital operations seem free from risk to life, one-half of them have led to functional derangements, such as corneal ulcers, immobility of the eye, ptosis, optic atrophy and glaucoma. In all but a few cases, hitherto, ligation of the superior ophthalmic vein has followed ligation of the carotid, and it is impossible to tell, in such instances, how much of the good result is attributable to the first operation.

Some observers think that the most certain way to achieve success is to combine ligation of the common carotid and superior ophthalmic vein on the same side, this bringing about obstruction of both afferent and efferent channels to the varix.

After tying the carotid, the superior thyroid artery plays an important part in the compensatory circulation, and is found dilated and strongly pulsating.

Briefly, the indications have been capitulated as follows:

Where brain symptoms are present, ligation of the common carotid is indicated, and where the clinical symptoms are confined to the orbit alone, or to the orbit and face, an orbital operation is the better, while it is well to ligate the ophthalmic vein in those cases where relapses have occurred or where ligation of the carotid has failed. In such cases, indeed, this operation should be given the preference over ligating the common carotid of the opposite side, since the latter is apt to excite too great a disturbance of the cerebral circulation.

Feruglio postulates the following:

The relief from pulsating exophthalmos, by orbital operations alone, can only be accomplished in those cases in which the altered tissues lie *within the orbit*, or in cases where an aneurism of the carotid, by pressure upon the ophthalmic vein, is the cause of this condition. Where there is an aneurismal varix, which constitutes the essential cause in about 70% of cases, no intraorbital operation alone will relieve the patient.

Study of the literature has been disappointing to the writer, in that it has revealed no attempt to compare ligation of the internal carotid with that of the common carotid artery—in fact, in that it has demonstrated the relative infrequency of the former operation, despite the higher percentage of cures obtained and its definite applicability to those cases with cerebral symptoms. Wilder, eight years ago, told of a rather extraordinary case, unrelieved by other procedures, in which ligation of the internal carotid was at last resorted to with excellent results. Swift and, later, Hartshorne, in this journal, have reported remarkable instances of the efficacy of this procedure, and it seems quite likely that Behan's recently described case would be living today had the internal carotid ligation not been augmented by tying of the common carotid artery.

The prognosis, following operations, is, again, variously recorded, being tersely summed up by one writer as favorable for life and distinctly conservative for vision.

A certain number of ligations of the carotid are followed by disturbances of the central nervous system, which usually manifests itself as a complete or partial hemiplegia, often associated with aphasia. Disturbance of cerebral functions, together with complications at the site of the ligation, such as secondary hemorrhages or infections, may occur.

In de Schweinitz and Holloway's thirty-four cases, brain symptoms ensued in five, following ligation of the common carotid, one after ligation of the common and internal carotids and one after ligation of the external and internal carotids. In one case the patient was irritable and easily excited, with thick, slurred speech, for one week after operation. Another, three days after the second common carotid ligation, had a series of convulsive seizures, followed by paralysis of the left side and almost continuous convulsions. Still another, immediately after ligation, developed a

paresis of the left side of the face with deviation of the tongue to the same side, entire left sided paresis ensuing the next day. Yet another, fourteen days after ligation of the common and internal carotids, evinced a gradually increasing paralysis of the right arm, with impaired sensation, also delirium and psychic disturbances. Another, thirteen days after ligation of the external and internal carotids, suddenly fell to the floor with complete paralysis of the right side. Cerebral disturbances followed in 9.8% of the total number of common carotid ligations.

In a few cases, all symptoms cease after a year or two, but death may ensue from involvement of the brain thru hemorrhage or infection.

All in all, the outlook is not as bad as a few writers have pictured it. In eighty cases only nine died—11%. The carotid walls seem to heal in about 50%, either thru natural means, pressure or the result of an operation. When pulsating exophthalmos depends upon *fracture of the skull*, the prognosis is not good. In a series of one hundred and thirteen cases of ligatory operations only ten died, three from infection (all being prior to the days of aseptic surgery), two from hemorrhage, and one each from changes in the blood vessels, anemia and general debility.

CONCLUSIONS.—1. In pulsating exophthalmos from true internal carotid-cavernous sinus communication, ligation of the internal carotid offers more certain results than any other operation.

2. If the collateral circulation is prepared by daily compression of the carotid, for several weeks prior to the ligation, there is little likelihood of danger therefrom.

3. If this fails or only partially relieves, after a sufficient period of observation, tying of the ophthalmic vein should be resorted to before considering other carotid ligations.

REFERENCES.

Lindenmeyer, O. Klin. Monatsbl. f. Augenheilk., lxvii, 1922.
Behan, J. L. N. Y. State Journal of Medicine, Oct., 1921.
Key, B. W. Annual Meeting Med. Soc., State of N. Y., May, 1921.
Swift, Geo. Am. Jour. of Ophthalmology, Feb., 1921.
Fenton, R. Jour. A. M. A., Oct., 1915.
Zentmayer, Wm. Jour. A. M. A., lxvii, No. 3, 1916.
Bedell. Archives of Ophth., xliv, No. 2, 1915.
Sattler, C. H. Handbuch der ges. Augenheilk., Bd. 9, Kap. 13, 1921.
Franke, E. Klin. Monatsbl. für Augenheilk., Bd. lxvii, S. 366, 1921.
Thierry. Rec. d'Opht., Oct., 1908.
Wilder. Tr. Am. Ophth. Soc., 1911.
Feruglio. Ann. di Ottalmol., Pavia, 1913.
Cauchoix, A. Revue de Chirurgie, Paris, lix. No. 3, 1921.
de Lapersonne. Bulletin Acad. Méd., Paris, vol. 82, p. 515, 1919.
Boden. Deutsche Archiv. f. klin. Chir., Bd., 51, p. 605.
Noyes. Tr. Am. Ophth. Soc., vol. iii, p. 308.
von Nagy. Inaugural Dissertation, Tübingen, 1919.
Ruttin. Ophthal. Gesellsch. in Wien, Oct. 26, 1917.
Erggelet. Deutsche med. Woch., p. 447, 1920.
de Schweinitz and Holloway. Pulsating Exophthalmos, 1908.
Warbasse. Surgical Treatment, vol. ii, 1919.
Am. Encycloped. of Ophthl., 1919.
Ramsay, A. Maitland. Clinical Ophth., 1920.
Krause, F. N. Y. Med. Jr., May, 1916.
Ginsberg. Klin. Monats. f. Augenheilk., Dec., 1912.
Meissner. Wiener med. Blatt., No. 17, 1908.
Buchtel. Ophth. Record, Feb., 1913.
Kaz, R. Ophth. Rev., Aug., 1912.
Lystad. Klin. Monatsbl. f. Augenheilk., Jan., 1912.
Friedenwald. Am. Jour. Ophth., xxviii, p. 131.
Wolff. Archives of Ophth., xli, p. 514.
Hartshorne, I. Am. Jour. Ophth., May, 1921.
Pascale, G. Annali Ital. Di Chirugia, Naples, May 30, 1922.
Margarucci, O., and Gianelli, A. Policlinico, Rome, Sept. 1, 1922.
Ferrero, V. Archiv. Ital. Di Chirugia, Bologna, June, 1921.

A STUDY ON STRABISMUS.

E. LANDOLT, M.D.

PARIS.

Common misconceptions regarding the ocular movements are here combated, especially the fixing of attention chiefly on the particular muscles. Attendant ambylopia is regarded as the cause and not the effect of squint. A consequence of convergent strabismus is limitation of lateral movement. The operative treatment should be limited to advancement and resection. Tenotomy should be avoided. Divergent strabismus is treated in conformity to the same principles. For vertical strabismus, vigorous advancement is advised and tenotomy of an inferior rectus never done. Insufficiency of convergence needs advancement of the interni, and paralytic strabismus often demands advancement.

The anatomy of the motor apparatus of the eye is so simple in appearance, that it has always fascinated the tyro, who sees nothing beyond the six extrinsic muscles of each eye, and believes that by these he can explain all the phenomena of ocular motility and its perturbations. It is due to such an elementary conception that important affections, such as strabismus and motor insufficiencies, are so frequently misunderstood and mistreated. I might be permitted to give a resumé of what observation, thought and experience have taught me concerning the surgical treatment of strabismus.

Above all things, let us not speak of ocular muscles. It is impossible and even useless to assign to each muscle of the eyes the part to which it is entitled in directing each of the eyes for the different positions and distances of the object looked at. In fact, the ocular muscles should not be considered as isolated anatomic units. The student already notices how intimately they are associated. Do they not enclose the ocular globe in an uninterrupted envelope, a complete motor apparatus capable of imparting every imaginable direction to the eye?

Furthermore, by their innervation, the motor apparatus of both eyes are united in a manner to collaborate constantly, in order that the visual lines of both eyes may always be directed simultaneously toward the point which attracts the attention of the individual. In this manner binocular vision is obtained, that is to say, the fusion into a single sensation of the impression received by the foveae centrales of both eyes, from which results the sensation of the third dimension.

If the object is situated at infinity, its fixation requires the parallelism of the visual lines. If the distant object is displaced horizontally or vertically, or in an intermediary direction, both eyes follow it in executing what we call the associated movements.

But, if the object is at a finite distance, its fixation necessitates the convergence of the visual lines, that is, symmetric innervation of both eyes. If the point of fixation lies on the median line, the two eyes turn inward simultaneously and execute the same angle of convergence. If the object approaches along the visual line of one of the eyes, the right eye for instance, this eye will not need to change its direction in order to fix the object, the other eye alone (the left in this instance) is obliged to execute a rotation (adduction) in order to fix the object. But the innervation of convergence, nevertheless, concerns both eyes; only with the excitation of this symmetric movement is combined, in this case, an excitation of an associated movement, to the right.

This latter innervation counterbalances, in the right eye, the impulse of movement toward the left, and to that extent augments the impulse of movement of the left eye toward the right. The same effect, of course, is produced when the approaching object is situated on the temporal side.

The innervation of convergence is indeed analogous to that of accommodation; for the one as well as for the other, both eyes always receive the same nervous impulse. One cannot accommodate more with one eye than with the other. But the correct direction of the two eyes toward the object of fixation is not sufficient to realize perfect binoc-

ular vision. It does not suffice that the images of the object are simultaneously formed on the foveae centrales of the two retinas. The images must, in addition, be sharply defined. In other words, both eyes must be optically adapted to the distance of the object. This adaptation is normally accomplished by means of the accommodation.

The normal condition of the refraction of the eye is emmetropia. In the normal state, the two functions, convergence and accommodation, are thus always exercised in the same degree in the interest of binocular vision. Thus, if the object being fixed is at infinity, the visual lines are parallel; convergence then is nil, and the accommodation, being at rest, is equally nil. If the object approaches, the two functions are always required in the same degree, and this degree is greater in proportion as the object fixed is brought nearer. The degree of the convergence, as well as that of the acommodation required for binocular and clear vision, is thus inversely proportional to the distance which separates the object from the eyes.

If we call "d" the distance which separates the object fixed from the eyes, "c" the convergence and "a" the accommodation, we can say that c and a = 1/D. In fact, the same unit has been chosen for the measure of both functions. The effort necessary to fix an object situated on the median line at one meter from the eyes is called the meter angle ("ma") for the convergence and diopter ("D") for the accommodation. If the object is situated at 1/2 m. it requires 2 meter angles of convergence and 2 diopters of accommodation; at 1/3 m. 3 ma. of convergence and 3 D. of accommodation; at 1/4 m., 4 ma., and 4 D., etc. This is the way things occur in a normal condition, that is in emmetropia. There is no doubt that embryologically the nervous centers of these two functions are predisposed to furnish always automatically the same degree of nervous impulse. But it is also evident that, if the static refraction is not emmetropic, but ametropic, the two functions will no longer be required in the same degree. Since convergence depends only upon the distance of the object, it is the same, no matter what the refraction of the eyes may be.

The accommodation, on the contrary, depends not only upon the distance of the object, but also upon the static refraction of the eye. If, for example, the eyes are hypermetropic, distinct vision will always require an effort of accommodation greater than the effort of convergence. Thus, a person with hypermetropic eyes of 3 diopters, for instance, in order to see distinctly at infinity is already obliged to use 3 diopters of accommodation, the convergence still being nil, and if, at one meter, the convergence (c) is equal to 1 ma., the accommodation (a) required, is 1 plus 3=4 D. At $\frac{1m}{3}$, c is 3 ma. and the accommodation "a" =3+3=6 D.

If then the two functions were put into action to the same degree, the individual would have single vision because his eyes would be properly directed; but his vision would be indistinct, on account of insufficient accommodation; the retinal images would not be sharp. If, on the contrary, he would put into use the effort of accommodation necessary to see distinctly, 3 diopters in our example, to see at infinity, the object would appear double, because he would associate with this effort of 3 D. of accommodation an exaggerated effort of convergence of 3 ma. And, note well, it is 3 ma. for each eye, thus 2 times 3=6 ma. for both eyes together.

In fact, one of the eyes being naturally directed to the object which attracts the attention of the individual, this excess of convergence will manifest itself entirely on the other eye. For example, there will be convergent strabismus of 6 ma., that is to say of approximately 10 degrees, and if there exists between the two retinas the normal relation required by binocular vision, this strabismus will be accompanied by a homonymous diplopia of 10 degrees. To escape the dilemma of seeing single but confusedly, or clearly but double, the relation between convergence and accommodation must be modified. In hypermetropia, for example, the same degree of convergence must always be accom-

panied by a greater amount of accommodation corresponding to the degree of hypermetropia. Is this possible? Certainly it is possible. Common sense demands it already and the experiments of Donders ([1-2]), on the relative range of accommodation and convergence, indicate, for the different conditions of static refraction, by how much for the same degree of convergence the accommodation, and for a similar degree of accommodation the convergence, may be increased or diminished.

Finally, ametropes daily show that it is easy to modify the relation between convergence and accommodation in the interest of perfect vision. Otherwise all hypermetropes would acquire convergent strabismus, if they wanted to see distinctly. And this strabismus would be unbearable if they were endowed with binocular vision, because, as already stated, it would be accompanied with homonymous diplopia. In fact, in the interest of binocular vision, the relation preestablished between convergence and accommodation is modified in ametropia. But when binocular vision does not exist, for example when the visual acuity of one eye is defective to the point that its collaboration with the other eye has not much value, then the individual quickly learns to disregard the impression received by the amblyopic eye, and does not perceive the diplopia which would result from a false direction of the eyes. He then remains under the influence of the preestablished relation between convergence and accommodation.

For example, in a child having a corneal leucoma or a deeper lesion of his left eye, his right eye being healthy but hypermetropic, binocular vision would not be developed, and the relation between the two functions under discussion remains the same as for emmetropia. The child, in fixing the object, would use his right eye only, and leave the relative direction of his eyes (convergence) under the normal influence of accommodation. In this way, the convergent strabismus of hypermetropes originates ([3-4]). From this it follows that, instead of saying: "a person squints with the left eye," or speaking of a "left convergent strabismus," it would be more appropriate to say: "the patient has a concomitant convergent strabismus and uses his right eye for fixation." In this manner, we express ourselves in conformity with the etiology of concomitant convergent strabismus.

We will soon see that it is the same in concomitant divergent strabismus. Concomitant strabismus is, in fact, always a binocular affection. It is one of the deplorable errors, which still remains so fatal in the treatment of this form of strabismus, to consider it as a matter concerning one eye only, the "Schielauge" of the Germans. Contrary to the teaching of von Graefe, which is still popular, I do not consider the amblyopia of the deviating eye as the consequence of strabismus. I do not approve of their "amblyopia ex anopsia," a barbarous expression which should signify an amblyopia due to lack of exercise. For me, on the contrary, amblyopia exists prior to the strabismus, and is one of its principal causes. Those who accept blindly the theories of consecrated masters should but remember, that eyes, deprived of sight for many years by cataract, do not become amblyopic but immediately recover an excellent vision, as soon as the cataract is removed. On the contrary, after correction of strabismus, the eye, which formerly deviated, gains but little in acuity of vision, tho able to acquire a role in binocular vision. To Donders is due the honor of having explained the etiology of concomitant strabismus, having been the first to study the relation between convergence and accommodation. After what I have stated, it will be unnecessary to refute the absurd objection against Donders' theory, that is to say, if it were true, all hypermetropes would squint inward. We do not deny that all who are afflicted with convergent strabismus are not hypermetropes. But these cases are very rare, especially when we consider the times of appearance of the strabismus. Hyperopia generally diminishes with age. If it has been slight at the beginning of the strabismus, it may later change to emmetropia; but the consequences of the strabismus, soon to be mentioned, in the absence of binocular vision, maintain the false relative direction of the eyes.

Further, it is not only a defect of static refraction, (hyperopia) but also a defect of dynamic refraction, (paresis or weakness of accommodation) which, demanding an exaggerated effort of accommodation, may provoke an excess of convergence which leads to convergent strabismus. Finally, one often forgets that infants are far from being exempt from paresis of an abductor muscle. When one of these little ones, afflicted with convergent strabismus, is brought to the clinic, one usually believes that one has to deal with concomitant strabismus. When the little patient is an emmetrope or a myope, one thinks of having found a proof against Donders' explanation of the convergent concomitant strabismus. Of the many cases of this kind which I have observed, the following is particularly characteristic.

A child of about 6 years, hyperopic in both eyes, with congenital convergent strabismus of 23 degrees and corresponding homonymous diplopia, was brought to me. The temporal excursion was extremely limited in the left, the deviating eye; while in the right eye, the excursions were normal. Here, beyond doubt, was a case of paresis of the left externus. I suggested to the mother to advance the paralysed muscle. Frightened at the idea of a surgical intervention, she consulted a professor, the author of several works on strabismus, who assured her that an operation was unnecessary and that atropin and correcting glasses would cure the strabismus. When, after several months, there was no improvement, the learned man concluded, that an operation was necessary. He began by tenotomising the internus of the effected eye, then that of the unaffected eye, thus, complicating the paresis of the externus of one eye with a paresis of both interni, so that finally the unfortunate child had homonymous diplopia for distant and crossed diplopia for near vision.

CONSEQUENCES OF CONVERGENT CONCOMITANT STRABISMUS.

We have seen that the amblyopia of the deviated eye is not the consequence of strabismus, as is still maintained by some writers of textbooks. If, instead of making theories, they had taken the pains to examine the motor functions of the eye, they would have established a most important fact, a fact capable of preventing the promulgation of errors in the diagnosis and treatment of strabismus. Thus, we see passing from textbook to textbook, the statement that concomitant strabismus differs from paralytic strabismus by the fact, that in the former excursions of the eyes are normal, while in the latter they are limited in the sphere of action of the paralysed muscles.

Since 1874, I have accurately examined the movements of the eyes in all motor anomalies, both before and after surgical interventions. By this means I have ascertained that, when the concomitant convergent strabismus has lasted a certain time, the temporal excursions are always limited in both eyes, but especially in the eye that habitually deviates.

The opposite excursions, that is towards the nose, in convergent strabismus, are not more extensive than normally, as has been contended without proof, in order to justify the tenotomy of the adductor muscles. ([5])

Of course, I have always considered the limitation of the temporal excursions of the eyes affected with convergent strabismus as the consequence, and not as the cause of strabismus. The abductors in this case lack exercise, especially in the symmetric movements. If, on the other hand, the absence of binocular vision is one of the principal causes of strabismus, the defective direction of the eye, in turn, becomes an obstacle to the development of this function. The individual thus finds himself in a vicious circle: he squints because his binocular vision is not developed, and binocular vision is not developed because he squints.

TREATMENT OF CONVERGENT CONCOMITANT STRABISMUS.

As in all rational therapeutics, the treatment of strabismus must be based upon the etiology of the disease. As the principal cause of concomitant convergent strabismus, we have found am-

blyopia of one eye, which opposes the development of binocular vision; hyperopia which provokes an excessive effort of the accommodation and consequently of the convergence.

Thus we will do all in our power, first, to augment the visual acuity of the weak eye by optical correction and visual exercises. Secondly, we will try to break the spasm of convergence by paralysing (by atropin) the accommodation, and by depriving the patient of all effort to accommodate, by means of convex lenses. To avoid the least tendency of accommodation or convergence, we will suppress or limit all near work. Thirdly, we will try to procure for the patient the simultaneous perception of the visual impressions of both eyes. We have him look at a distant light. A colored glass placed before one of his eyes will aid us in verifying his answers. Fourthly, unless there is a very decided amblyopia of one of the eyes, we institute stereoscopic exercises, in order to produce, first, simultaneous vision, then the fusion of the two images, and finally the perception of the third dimension, which results when appropriate images are presented to the patient. With patience and perseverance, one sometimes succeeds in curing the favorable cases of strabismus in this manner. But almost always the patients are brought to us at a time, when, in consequence of the long duration of the strabismus, the muscular alterations, previously mentioned, have already been produced. In this event, recourse must be had to surgical intervention. Of what will this surgical intervention, the operation for strabismus, consist? There are, alas, still some ophthalmologists, who, seeing but one squinting eye, attack the "Schielauge," and cut the "Schielmuskel," the internus "which makes the eye turn inwards".

If, as is very often the case, this operation is not sufficient to "straighten the eye," they continue, and tenotomise the internus of the other eye, or they move the new insertion of the tonotomised muscle further back by advancing its antagonist, or even tear the eye forcibly out of its muscular funnel by means of the "Fadenoperation" of von Graefe.

What is the aim of these operations? The socalled "correcting the strabismus," and by this is meant to give the eyes a parallel direction when looking straight forward.

When one has obtained this parallelism of the eyes, by drawing back the interni, it nearly always follows that, in a short while, a divergent strabismus ensues, much worse than the original convergent strabismus. In any event the eyes remain disfigured by the retraction of the caruncle and the protrusion of the eyeball. But the worst of all is that the convergence is either entirely destroyed, or reduced to a degree that, if binocular vision existed, the patient would suffer from unbearable crossed diplopia. He is thus justified in opposing instinctively the reestablishment of binocular vision, which, otherwise, is as precious, completes the cure of strabismus and insures its persistence.

The surgical intervention that consists in tenotomy, that is to say in the setting back an ocular muscle, errs first because it is based upon the absurd idea that the concomitant strabismus is a monocular affection, produced by a faulty insertion or an excessive contraction of one muscle; secondly, by an absolute erroneous appreciation of the effect of operations on the muscles. My investigations concerning the effect of operations on the motor apparatus of the eyes ([6-7-8-9]) demonstrate, (A) that the tenotomy of a muscle produces the same effect as its paresis. First: Limitation of the excursion in the sphere of action of the tenotomised muscle, without increasing the movement in the opposite direction. Second: Limitation, or complete abolition of the convergence in the case of tenotomy of an adductor. Third: False projection in the direction of the tenotomised muscle. (B) That the advancement of a muscle produces an effect just opposite to the tenotomy, or to the paresis of a muscle, i.e. First: It increases the excursion of the eye in the direction of the advanced muscle, without diminishing the excursion in the opposite

direction, nor does it tend to affect the convergence in the case of the advancement of the abductors. Second: It reestablished the normal projection in the case of the advancement of a paralysed muscle.

From this, it follows, that in place of weakening the adductor muscles by tenotomy in the case of convergent concomitant strabismus, the abductors should be reenforced by the advancement of their insertions.

THE DEGREE OF OPERATION IN STRABISMUS.

The surgical intervention in case of strabismus may consist in the simple detachment and reattachment of an ocular muscle near the corneal margin (simple advancement), or in a combination of the advancement with the shortening or resection of the muscle. I always perform the resection at the end, not in the middle of the muscle. The resection may be slight, medium or great.

Resection of the muscle, without displacement of its insertion, is less efficient than the advancement, which increases the extent of the muscle on the ocular globe. It is especially much less efficient than the combination of advancement with resection. I have practiced formerly the resection of the muscle without touching its normal insertion, in order to avoid a rotation of the eye around its transverse or anteroposterior axis; but with careful advancement (especially with my method of suturing), such a displacement of the eye is not to be feared.

The choice of the operative procedure depends on a number of circumstances, which the operator should take into consideration; the duration of the strabismus, the degree of the deviation, and the limitation of the excursions, the age of the patient, and the help that can be expected from reestablishing binocular vision. In a case of true strabismus, I always operate on both eyes at the same sitting. Only in a deviation of a few degrees, or as will soon be seen, in insufficiency of convergence, do I practice advancement on one eye only, operating on the other later, if the effect of the first intervention has not been sufficient.

After what we have said about the binocular nature of concomitant strabismus, it is not necessary to state, that, even if practiced on one eye alone, the operation always concerns both eyes. It is also selfevident, that always a binocular dressing is to be applied until the cicatrization is complete (7 to 8 days for a convergent, and 6 to 7 days for a divergent strabismus). In fact, the movements of the unbandaged eye would forcibly drag the operated eye with it, to the damage of the firm attachment of the muscle that has been advanced.

Entering into the details of the technic of the operation and the consecutive treatment would lead us far beyond the limits of this article. I regret it, because all details, however small, have their great importance. Where would we have to begin with such explanations. I remember, that only last year, a professor of opthalmology told me that he operates now for strabismus also by muscular advancement, but combined with tenotomy, and only on the "Schielauge," and that he bandages only the eye operated upon!

The etiology of the concomitant divergent strabismus of myopes is analogous to the convergent strabismus of hyperopes. If the insufficiency of the static refraction, which is hyperopia, can bring on an excess of convergence, the excess of static refraction which represents myopia, predisposes the patient to a defect of convergence, providing always that binocular vision, which governs the convergence, does not prevent it. Let us take a myope of 3 dioptrers. From infinity to 1/3 m., he does not need accommodation, while the convergence required by the approach of the object fixed increases from zero up to 3 ma. And, when the object approaches from this distance, the effort of accommodation required always remains 3 units, that is to say, 3 D. below that of convergence.

If the individual uses but one eye for fixation, and abandons himself to the relation between accommodation and

convergence preestablished for emmetropia, he already has a relative divergent strabismus from the gaze at infinity. For fixing an object, situated at 1/3 m., this divergent strabismus would be 3 ma. for each eye, that is to say 6 ma. for the nonfixing eye alone.

Only, as well as for the hypermetrope with tolerably good vision, the relation between the two functions is modified for the myope in the interest of binocular vision. The myope learns to harmonize his convergence and his accommodation; he converges properly, but accommodates less than the emmetrope. It is true that, if the object of fixation is hidden from one eye of the myope, this eye deviates outwards, at least relatively, while the other eye fixes the object. This is quite natural. Fixing with one eye only, the individual is not annoyed with the diplopia which would occur if both eyes were used. Consequently he leaves them to their state of muscular equilibrium, which is nearly always divergence. The unoccluded eye being directed to the object which attracts the attention, the divergence manifests itself on the covered eye only. This condition was called by von Graefe's School "insufficiency of the internal recti," considered as a cause of asthenopia, and even of the progress of myopia. To cure it, tenotomy of the external recti was practiced, and a paretic convergent strabismus with homonymous diplopia created.

During an ophthalmologic meeting in Heidelberg, I heard the statement that the insufficiency of the interni of the myopes can be cured by concave lenses. Of course, the myope wearing his correcting glasses becomes an emmetrope, and like the emmetrope is guided by the accommodation he puts into action, when fixing a near object. He therefore converges properly even when one of his eyes is excluded. The optic correction of the fixing eye alone would suffice to cure, instantaneously, this socalled insufficiency of the interni.

In fact, convergence is an effort for every one, and this effort is only made in the interest of binocular vision, except with certain hyperopes, where convergence accompanies accommodation, even to a disproportionate degree. Now, if binocular vision is lacking, the individual, without being a myope, does not make this useless effort. He no longer converges; he diverges. At first the divergence is relative, but later it becomes absolute. We can daily observe this fact. When a person, enjoying perfect binocular vision, suddenly loses the sight in one eye, divergent strabismus is soon established. As we see here again, the amblyopia is not the consequence, but the cause of the strabismus. One used to say then: "An amaurotic eye deviates outwards," or "the patient is affected with a divergent strabismus of the amaurotic eye" say the left. This consideration of the matter, altho corresponding apparently to reality, is not quite correct. We should say: The patient has divergent strabismus and fixes with his good eye, the right in our example. Here again the divergence concerns both eyes and not only the apparently deviating eye.

Like convergent strabismus, divergent concomitant strabismus is a binocular affection. The etiology, just discussed, proves it. The examination of the excursions of the eyes confirms it. In fact, the fields of fixation of both eyes are always limited on the nasal side, in proportion to the degree and the duration of the strabismus.

TREATMENT OF DIVERGENT CONCOMITANT STRABISMUS.

After all that has preceded, we can be brief concerning the treatment of divergent strabismus. It is based on the same principles as the treatment of divergent strabismus. but orthoptic methods here have less chance of success than in convergent strabismus, especially before the surgical strengthening of the power of convergence. The weakness of the adductor muscles of both eyes, above described, suggests clearly in what this operation has to consist: the advancement of both internal recti. Experience has taught me that frequently a combination of advancement with resection is desirable, in order to give the eyes not only a parallel direction in a state of repose

but also the ability to converge for near vision. It is selfevident that, if the visual acuity of the habitually deviating eye can be improved by any means, exercises be applied to restore binocular vision.

VERTICAL STRABISMUS.

Vertical deviations of the visual lines are rather rare, and never attain as high a degree as horizontal deviations. They are often associated with the latter. Thus, when convergent strabismus attains a high degree, the nonfixing eye often deviates slightly upward, while in high degrees of divergent strabismus, the deviating eye is usually directed more or less downward. These differences of the level of the eyes nearly always disappear when the horizontal strabismus is properly corrected by muscular advancement.

A difference of level, important enough to prevent the reestablishment of binocular vision, or causing disfigurement, must be corrected surgically. Only in slight vertical deviations can a tenotomy of a superior rectus be considered. The weakening of the muscle created by this operation will be felt only in looking upward; but this defect never occurs to a very marked degree and is easily corrected by the movement of the head. Tenotomy of an inferior rectus must never be performed. If, by this operation, the eyes have been placed on a level when looking straight forward, the loss of motility of the tenotomized eye would make itself greatly felt in the lower field, the most important direction for the eyes. On the contrary, whenever the sursumvergent strabismus attains the least degree of importance, the inferior rectus should be advanced energetically. I purposely say "energetically," because my researches have demonstrated that the operations on the vertical motor muscles have much less effect than those practiced on the muscles acting in the horizontal plane. ([10])

INSUFFICIENCY OF CONVERGENCE.

Those, who only know the muscles of the eyes, designate this affection, "insufficiency of the internal recti."

In 1885, at the Ophthalmological Congress in Heidelberg, I demonstrated that convergence must be considered as a special function. I showed how it can be measured easily with my dynamometer and estimated in Nagel's meter angles. ([11])

After having established the amplitude of convergence under normal conditions, the relation between that part of the available positive convergence and that part of it that must be kept in reserve for prolonged work, I have been able to give not only a precise definition of convergence insufficiency, but also accurate indications for its treatment.

I have explained why prisms so rarely give satisfaction and what surgical intervention is indicated to correct an insufficient convergence ([12]). From the foregoing, we know that this intervention advised is the advancement of one or both internal recti. An external rectus should never be tenotomized. This operation complicates the convergence insufficiency with a convergent paretic strabismus, and homonymous diplopia. The unfortunate patients suffer then from homonymous diplopia when looking in the distance, and from crossed diplopia in looking near at hand. I had more than once to advance an externus set back by an adept of this theory, and to advance an internus to correct the insufficiency of convergence.

PARALYTIC STRABISMUS.

We can not enter here into the vast domain of the etiology of paralytic strabismus, nor that of the general treatment based on it ([12]). I wish to say only a few words on the surgical treatment of paralytic strabismus, which is to be resorted to when medical treatment is not efficacious. The indications of the surgical intervention follow directly upon what has been said concerning the effect of the operations on the ocular muscles.

Since the tenotomy of a muscle is equivalent to its paresis, those who, like von Graefe, tenotomise the antagonist of a paretic muscle, add another paresis to the original one. In

a paresis of an external rectus, A. von Graefe even considered it the ideal treatment to tenotomize all other horizontal motors, even those of the healthy eye.

Advancement, on the contrary, having just the opposite effect of the paresis of the muscle, is the logical treatment in such cases. It can give an absolutely ideal result, that is to say a complete restitutio ad integum, in the case of simple paresis, when the muscle has not completely lost its contractility. The excursion of the eye in the direction of the paretic muscle is restored without damage to the function of its antagonist. The false projection disappears. The cooperation of the operated eye in the separate associated as well as in the symmetric movements, becomes normal, which means that binocular fusion of the retinal images is perfect in all directions and at all distances. It goes without saying that the surgical intervention must conform to the degree of the paresis. The simple advancement of the muscle to the corneal border has given me perfect results in cases of paresis of the external rectus with a deviation and diplopia up to 15°.

In the higher degrees, a resection of a more or less extensive part of the muscle is to be added to the advancement; thus the weakness of the muscle is compensated by its shortening together with its more favorable insertion. When the paralysis of a muscle is complete, surgery cannot increase a force which no longer exists, but it can nevertheless render great service to the patient. Let us take the most frequent case, that of a paralysis of an external rectus. If, before the paralysis, the patient had binocular vision, he is now greatly annoyed by homonymous diplopia. For example, in the case of paralysis of the left abductor, his visual lines will only meet when looking towards the extreme right. In order to see binocularly, he is obliged to turn his head forcibly to the left. But this unaccustomed movement is so laborious, that he prefers to give up binocular vision and to close or cover his left eye.

In such a case, we can, at least, give the deviating eye a more favorable direction in bringing it up to the middle of the palpebral opening. This is obtained by a very large resection of the paralysed muscle, and its attachment as close as possible to the corneal margin. In this manner, the visual lines meet in front of the patient. He sees binocularly single while looking at objects directly before him. It is true that, in the horizontal plane, he will have to follow the fixed object by turning his head, since the affected eye is immobile to the left on acount of paralysis of the abductor, and restricted in his excursion toward the right, on account of the considerable shortening of the muscle. May it be well understood that it is only the extreme shortening of a muscle required by a total paralysis, that diminishes the excursion of the eye in the opposite direction. This never occurs in an operation for a simple paresis and even less after advancement for a comitant strabismus. In a total paralysis of an external rectus, I would not combine the advancement and resection of the paralysed muscle with a tenotomy of the internus. I would prefer to augment the effect of the first operation by the advancement of the externus on the other eye.

Next to the paralysis of the external rectus, that of the superior oblique is the more frequent. It is true that this muscle is not easily accessible to a surgical intervention, but the advancement combined with resection of the inferior rectus has given me the most excellent results, as to the reestablishment of the harmonious collaboration of the two eyes in case of paresis of the superior oblique.

But I must stop! The reader, if there be one, who has had patience enough to follow me thus far, will perhaps find that I have told him nothing new. I beg his pardon and thank him for this compliment. Does not he prove thus, that my former works are not unknown to him? I even presume that he is of my opinion, for those who have preconceived ideas will refrain from reading that which might shake

their faith. If I had had the advantage of speaking to the Washington International Congress, I probably would not have preached only to converts; that is one of the advantages of the spoken word over the written one.

But those who agree with me may console themselves. If I have made repetitions, that which I have said in this article has at least the advantage over what I have formerly stated, in that it is based on a longer experience and therefore merits still greater confidence.

BIBLIOGRAPHY.

1. Donders. Accommodation and refraction of the eye. Ed. 1864, p. 110.
2. Landolt, E. The refraction and accommodation of the eye. p. 200.
3. Landolt, E. L'etiologie du strabisme. Arch. d'Opht., 1897, v. 17, p. 74.
4. Landolt, E. Defective ocular movements and their diagnosis. Ed. Hodder and Stoughton, London, 1913, pp. 12-25.
5. Landolt, E. Les mouvements des yeux a l'etat normal et a l'etat pathologique. Congres internat. des Sciences Méd. Sect. d'Opht., 1881, p. 25, Arch. d'Opht., 1881, v 1. Examination des mouvements des yeux. Ed. Masson, Paris, 1916.
6. Landolt, E. Traitment chirurgical du strabisme. Arch. d'Opht., 1895, v. 15. Norris and Oliver. System of diseases of the eye. v. 4, p. 111.
7. Landolt, E. Ophthalmic Surgery. Bowman Lecture. Trans. Ophth. Soc. United Kingdom, 1911, v. 31.
8. Landolt, E. Die chirurgische Eingriffe bei Stoerungen des Bewegungsapparates der Augen. Graefe-Saemisch Handbuch der ges. Augenh., 1905, Abschnitt 10.
9. Landolt, E. La tenotomia. Arch. de Oft. Hisp.-Amer., 1918, June.
10. Landolt, E. Les operations sur les muscles moteurs verticaux des yeux. Arch. d'Opht., 1912, p. 593.
11. Landolt, E. Die Insuffizienz des Convergenzvermoegen. Heidelberg, 1885. Defective ocular movements and their diagnosis. Heidelberg, 1885, p. 18. Asthenopie motrice. Congres de la Societe d'Ophthalmologie Belge, Bruxelles, 1910.
12. Landolt, E. Norris and Oliver System of Diseases of the Eye. 1900, v. 4, p. 149.

CONSIDERATIONS OF OCULAR VERGENCE.

G. F. Alexander, M.B.

Scarborough, England.

The nomenclature and significance of different conditions of ocular vergence are here discussed. The static vergence and the dynamic are distinguished, and the factors that join in producing them are considered in detail. Heterophoria and strabismus may arise from faults in either. Stability of normal static vergence is the protection from this defect.

While ophthalmic science is indebted to Dr. Stevens for his terms expressive of the state of ocular vergence on the removal of the "incentive to binocular fixation," (i.e. the simultaneous formation of the images of an object on the retina in both eyes) by screening one eye or the use of the Maddox rod, it cannot be said that his definitions of these terms, or those of other writers, are altogether satisfactory.

The definitions given on page 215 of "Motor Apparatus of the Eyes" by Geo. T. Stevens are as follows:—Orthophoria is a "tending of the visual lines in parallelism, the determination being made for a point not less than 6 meters distant;" and heterophoria is a "tending of these lines in some other way, the determination being made for a distant point as above indicated," and esophoria and exophoria are described as "conditions of heterophoria."

In criticism of these definitions:—First, in their exemplification it is asserted that with a candle flame at 6 meters and the Maddox rod horizontal, if the streak passes thru the flame the visual axes are parallel; but this, tho universally accepted, is not strictly accurate, as for single vision, with the distance between the centers of rotation of the eyes 6.4 c.m., parallelism of rays does not as in the case of refraction begin at 6 meters; but at about 120 meters, as if we fix a point in the distant horizon, a fine vertical rod in the midsagittal line must be removed to this distance before

it appears single and well defined, hence with parallelism of the visual axes, there is crossed diplopia of an object at 6 meters with a linear displacement between the "twin-objects" of 6.4 c.m., i.e. apparent exophoria thru an angle of—

$$\text{tangent } \frac{6.4}{600} = .01 \text{ or practically } \tfrac{1}{2}°$$

as indicated on a 6 meter scale; from which it follows that binocular fixation of the light signifies convergence of ½°, and that to obtain the true deviation from parallelism we must in exophoria deduct ½° from, and in esophoria add ½° to, the number of degrees indicated on the scale.

Second, they are inapplicable to the vergence on near vision, tho Dr. Stevens by his use on pages 284, 290, and 291 of the terms "Esophoria and Exophoria on accommodation" so extends them. Regarding the definitions of orthophoria as "the persistence of the binocular fixation of an object on the removal of the incentive to it" and heterophoria as the contrary, with esophoria and exophoria as conditions of the latter, these are more satisfactory as avoiding the above inaccuracy, and being applicable to vision at all distances; but seem objectionable on the grounds that three degrees of heterophoria require recognition, viz. one which is normal, a second greater and very variable which is physiologic, and a third exceeding the physiologic. Normally on removal of the incentive to binocular fixation, slight divergence of the visual axes even for an object infinitely distant is revealed, as is proved by crossed diplopia of a near object or bright star being momentarily observed when, while viewing it with one eye screened, we suddenly remove the screen, and thus as the term heterophoria includes a condition which is not normal, it is obviously illogical to describe it unqualified as "latent strabismus," as this is tantamount to stating that all have "latent strabismus". This difficulty in the definition however might be overcome by using for heterophoria of a degree so great as to be productive of asthenopia the term *dysphoria*, as this may more correctly be described as "latent strabismus".

Again, if we take the Greek prefix as signifying "correct," i.e. normal, instead of "straight," which it seems preferable to do, as such persistence is not the normal state, we find the term orthophoria applied to an abnormal state and the term heterophoria including a normal one, and the attempt to get out of this difficulty by qualifying as "approximate" the binocular fixation, the persistence of which constitutes orthophoria, leads into another, viz. that as it is then required to indicate the nature of the departure from binocular fixation, esophoria and exophoria must be admitted as conditions of orthophoria as well as of heterophoria, whereas they are admitted as conditions of the latter only. Many consider it erroneous to classify as heterophoria the tendency to deviation due to ametropia and disappearing when the glasses correcting it are worn, terming it pseudoheterophoria, and confine the application of the term to cases persisting when the glasses correcting the ametropia are worn, or those having a myopathic basis. But it would be just as logical to term the actual deviation due to ametropia, which disappears when the glasses correcting it are worn, pseudostrabismus.

A good definition should be as simple and as general as possible, hence it seems desirable that the terms expressive of ocular vergence should be applicable to all phases of it, dynamic as well as static.

The tendency to departure from binocular fixation becoming the actuality when the incentive to binocular fixation is removed by screening or the use of the Maddox rod, and departure from binocular fixation implying that if one eye fixes an object the other deviates from it, we may define esophoria and exophoria as "the tendency to departure from binocular fixation revealed by inward and outward deviation respectively of the eye behind the screen or Maddox rod": (2) Orthophoria as "the maintenance of binocular fixation in freedom from asthenopia," implying either no tendency to departure from it, or such to a degree which for the individual is physiologic: (3) Heterophoria as "the maintenance of binocular fixation only by an effort which is productive of asthenopia", implying a tendency to departure from it to a degree which for the individual is greater than the physiologic: and (4) strabismus as "the departure from binocular fixa-

tion in the presence of the incentive to it."

Both heterophoria and strabismus may be neuropathic or myopathic. Heterophoria so defined may be described as "latent strabismus," or more logically as "the tendency to strabismus prevented from becoming the actuality."

The definition of strabismus as "the deviation of one eye from an object fixed by the other is unsatisfactory, 1st as applying to the deviations revealed by screening or the Maddox rod, and 2nd as being fundamentally the consequence of faulty relative vergence. "Insufficiency of convergence" is obviously of two degrees, a lower one in which binocular vision of a near object is possible, implying heterophoria (exophoria) on near vision, and a higher one in which it is not, implying strabismus on near vision.

The "fusion sense," so often referred to and so rarely defined, is evidently the desire for binocular single vision in the interests of orientation and stereoscopic vision, and a function of the psychic cortex, in the evolution of which, as the number of nondecussating fibers of the optic nerves reaches equality with that of those decussating, firstly the images falling on approximately corresponding points in the two retinae are projected to the same point in the spatial perimeter, and secondly if they are of sufficient similarity in size, form, and color, the separate sensations given by them are blended into a single sensation, and that in strabismus this faculty remains undisturbed and the diplopia is similar to physiologic diplopia is evident; (a) if the macular image in the deviating eye is not suppressed, or its suppression can be overcome, by the two objects fixed being projected to the same point in the spatial perimeter, and (b) if while the subject of a low degree of convergent strabismus fixes a distant object in the central sagittal line, a lighted candle at the level of his eyes is approached from the side of the deviating eye towards his nasal bridge, by the light when beyond the horopter including the intersection of the visual axes being seen in homonymous diplopia, when it arrives at the horopter being seen single, and when it is within the horopter being seen in crossed diplopia. Subservient to the fusion sense and exercised on the incentive to binocular fixation with the object of attaining it, is the dynamic vergence, the consideration of which, however, must be preceded by that static vergence.

THE STATIC VERGENCE.

This is the vergence revealed on eliminating the dynamic vergence by removing the incentive to binocular fixation; by, while the subject wearing the glasses correcting any ametropia which may be present views a distant object, screening one eye, or the use of the Maddox rod; and it is normal when approximate parallelism of the visual axes is shown on the scale.

Now, just as the ciliary muscles are maintained in a state of tonicity by the activity of a group of cells in the third nerve nuclei or "accommodation center," the opposing lateral rotators of each eye are maintained in states of tonicity, so coordinated as to establish the visual axes in their static vergence, by the activity of two other groups of cells in the same nuclei, the one which innervates the internal recti being the "convergence center" and the other which innervates the external recti the "divergence center," the former being of greater importance than the latter; as convergence is mainly a sustained muscular effort while divergence is mainly the relaxation of this effort.

Instability of the static vergence expresses the tendency of the functional activity of the convergence center to become relatively to that of the divergence center exalted or depressed.

THE DYNAMIC VERGENCE.

The activity of the above centers is variable, in the direction of convergence and subsequent divergence in return to the static state, under innervation impulses stimulating the convergence center while inhibiting the divergence center and the reverse. These vary in effect generally with the nervous strength of the individual and the efficiency of the rotators, and may be: A. volitional from the motor cortex, and either; (a) independent of accommodation, as is shown by convergence taking place in the absence of all innervation to accommodation when

the eyes are naturally, or are rendered by + lenses, so myopic that the object is beyond the far point; or (b) dependent on accommodation, as is shown on distant vision, with any ametropia which may be present corrected, by determining the static vergence by the Maddox rod and a 6 meter scale and noting the change in the position of the streak which follows placing before the eyes lenses rising from .25 D, esophoria in a degree proportional to their strength being usually observed with the weaker lenses. It is interesting to note, as bearing on the relation of hypermetropia to strabismus, that with those exceeding the amplitude of accommodation available no change in the position of the streak takes place, the innervation to accommodation not being exercised for a task beyond its power.

On near vision:—while accommodating for a near scale at the distance for which it is graduated, if the image of the scale is displaced from the macula in one eye by a prism having a deviating angle of 5° or 6° pointing down, and we note the position of the displaced zero line on the scale above it, placing before the eyes — lenses as above will be found to induce convergence.

In the evolution of the nervous system as we ascend the scale of animal life, convergence in the interest of single vision is of later development than accommodation in the interest of distinct vision, hence in man the frequent instability of the static vergence, and the subservience of convergence to accommodation, so that the activity of the accommodation center tends to induce a corresponding activity in the convergence center.

Thus if D be the number of diopters of accommodation and V the number of the vergents (*vergent* being a term proposed for the meter angle as being more convenient) associated with them, V tends to equal D, and in E., $V = D$. But in ametropia, when static parallelism of the visual axes has been preserved, accommodation and convergence become so dissociated that in H., $V < D$, and in M. $V > D$. From this it follows, that if prescribing for such cases for the first time late in life:

In H. the glasses correcting even the manifest degree tend on near vision to be productive of exophoria for a time; and in presbyopia the + increment to the distance glasses should be under the average, another reason for this being the hypertrophic state of the ciliary muscles from their supernormal activity, and:

In M. even the lowest glasses conferring full vision tend on near vision to be productive of esophoria for a time, and in presbyopia the + increment to the distance glasses should be above the average, another reason for this being the atrophic state of the ciliary muscles from their subnormal activity.

B. Reflex from the retinae, as is shown on viewing a distant object, and placing a prism in front of either eye, by the rotation of this eye towards its apex with the object of recovering the image, displaced from the macula in the direction of its base, on the macula. That this vergence is reflex is shown by outward and vertical rotation of the eye, as it is impossible for these movements to be made volitionally; but in inward rotation of the eye, caused by a prism pointing in, it is to a variable extent controllable volitionally.

The activity of this vergence varies specially with the distinctness with which the images are formed on the retinae, their similarity, and the visual acuity in each eye, and hence it is probable that the effect of the lenses correcting ametropia in curing strabismus, apart from their influence on the convergence center thru that on the accommodation center, lies in their stimulating this vergence by rendering the retinal images distinct, as this would account for + lenses proving curative of divergent strabismus in H. and — lenses proving curative of convergent strabismus in M.

Tho Worth's experiments with prisms on the eyes of young children seem conclusive, that in early life this vergence is often feebly developed, and that this state is a factor in the genesis of strabismus; that it is not the chief factor seems evident from the following consideration:

1. In cases of convergent strabismus with good vision in both eyes, in which correction has been obtained by advancement, the amplitude of the prismatic vergence may be found unimpaired, and it is generally so in the case of divergent strabismus so corrected.

2. In H., with the correcting glasses worn, when binocular fixation is proved to be present by the fusion of the red light rendered apparent by placing a red glass in front of one eye, while viewing a lighted candle at 6 meters with the white light, if we substitute a Maddox rod for the red glass and find the static vergence normal, tho the reflex vergence is thereby rendered nil, no change in the vergence may take place on removing the glasses.

3. Granted that in H. with normal static vergence nV of convergence of each eye were induced by the exercise of nD of accommodation, even if the reflex vergence were in total abeyance the strabismus caused would not exceed 2 nV, or 2 x 110/6 without the presence of another factor, whereas it usually greatly exceeds this degree. The relative amplitudes of accommodation and convergence vary with the stability of the static vergence and the strength of the reflex vergence. Consequently the less they are, the greater is the tendency to heterophoria and strabismus. But in young children it is naturally impossible to estimate the amplitude of accommodation, and in all cases it is impossible to estimate that of convergence by prisms pointing in, as it is generally beyond the deviation practically obtainable from them. But it may be estimated by increasing the strength of + lenses before the subject's eyes, and advancing in the central sagittal line a card of fine print, so that it occupies the focal plane of the lenses at the time in the trial frame; as the number of the diopters of the strongest convex lens with which the print can be seen in single vision is that of the vergence possible in the absence of accommodation.

Concomitant heterophoria and strabismus are due either to: (1) An initial fault in the static vergence, establishing the visual axes in convergence or divergence irrespective of the state of the refraction; or (2) instability of the static vergence, in consequence of which the visual axes are established in faulty vergence by a special or general influence. In either case, according as it is within or beyond the power of the dynamic vergence to secure binocular fixation, we have heterophoria or strabismus.

The instability of the static vergence is apparently congenital and frequently hereditary; and the special influence causing heterophoria or strabismus is ametropia, which acts on the instable static vergence on the physiologic principle of the "Summation of Stimuli" as follows: In H., in those cases of a low degree which can be corrected by accommodation, from its supernormal exercise, there follows exaltation in the functional activity of the accommodation center which induces exaltation out of proportion according to the degree of the instability in that of the convergence center; and, just as consequent on the former there is hypertonicity of the ciliary muscles, consequent on the latter there is hypertonicity of the internal recti productive of esophoria or convergent strabismus with concomitancy. The strabismus is at first manifested only when accommodation is exerted, i.e. is dynamic; and therefore disappears when the activity of the accommodation center is lowered to normal by wearing the correcting glasses, or suspended by atropin, or during sleep or chloroform narcosis, tho it may remain so for a long time it usually after a time, due to the exalted activity of the convergence centre becoming constant, becomes static; i.e. manifested even when the activity of the accommodation center is lowered or suspended by the above means. At a later stage in monocular strabismus, there takes place in the internal rectus of the deviating eye a contraction which introduces a myopathic element with consequent loss of eversion and concomitancy.

In M., from the subnormal exercise of accommodation, there follows depression in the functional activity of the accommodation center, which induces depression out of proportion according to the degree of instability in that of the convergence center; and just as consequent on the former there is lessened tonicity of the ciliary muscles, consequent on the latter there is lessened tonicity of the internal recti, productive of exophoria or divergent strabismus with concomitancy. The strabismus is at first manifested only on near vision; i.e. is dynamic and therefore disappears when the activity of the accommodation center is raised to normal by the correct-

ing glasses. But after a time, due to the depressed activity of the convergence center becoming constant, it becomes static; i.e. manifested even when the correcting glasses are worn. At a later stage, in monocular strabismus, there takes place in the internal rectus of the deviating eye, a relaxation which introduces a myopathic element with consequent loss of inversion and concomitancy. In high myopia, in the causation of exophoria and divergent strabismus, in addition to the innervational, we have a mechanical factor establishing the visual axes in static divergence; viz. that from the elongation of the globes the optic axes tend to assume the direction of the orbital axes, and hence there follows relative inefficiency of the internal recti with consequent loss of inversion by both eyes; but, as long as they are equally affected, no loss of concomitancy.

General causes of strabismus as fevers, central nervous disease, as epilepsy, reflex irritation, shock, etc., probably act by inducing or increasing the instability of the static vergence, and so rendering it amenable to the modifying influence of ametropia.

Immunity from strabismus in ametropia is secured by stability of the normal static vergence, i.e. the resistance it offers to the modifying influence of ametropia; and in the case of its instability by the strength of the reflex vergence, acting in support of the independent convergence in myopia and in opposition to the dependent convergence in hypermetropia, proving sufficient to prevent any tendency to strabismus from becoming the actuality. Naturally when this is the case there follows a dissociation of the volitional innervations to accommodation and convergence as above indicated.

GRADUATED TENOTOMY OF INFERIOR OBLIQUE IN CORRECTING CERTAIN FORMS OF SQUINT.

JOSEPH L. MCCOOL, M.D., F.A.C.S.

PORTLAND, OREGON.

Spasm of the inferior oblique secondary to paralysis of the superior rectus is the condition most frequently justifying this treatment. Eleven cases of this kind have been studied, seven showing palsy of the opposite superior rectus. In four the muscle primarily affected could not be determined. Partial rather than complete tenotomy is advised. Such partial divisions may be multiple. Read before The American Academy of Ophthalmology and Oto-Laryngology, September, 1922.

Congenital palsy of the superior rectus, with secondary spasm of the opposite inferior oblique, in all probability is the type of motor anomaly which more frequently demands a tenotomy of the latter muscle for its correction than any other.

Duane reported a number of cases of palsy of the superior rectus before the British Medical Association in 1906, and in that paper formulated the operative indications for its relief. Later, Posey presented a paper on the same subject before the American Ophthalmological Society. Todd read a paper before this society several years ago. White has reported seventy-five cases, thirty-five of which have come to operation. Good results were attained in all but two. White has classified his cases as follows:

Class 1. Paresis of the superior rectus, with spasm of the opposite inferior oblique.

Class 2. Paresis of the superior rectus, with spasm of the opposite inferior oblique and also spasm of the inferior rectus of the paretic eye.

Class 3. Paresis of the superior oblique, with spasm of the inferior oblique in the same eye.

I have studied eleven cases of spasm of the inferior oblique, of which number seven were secondary to a palsy of the opposite superior rectus. In the remaining four cases, I was unable to determine which muscle or muscles were primarily responsible for the spasm. Three of these cases were adults with convergent squint, in which contracture had undoubtedly taken place. In these three, a teno-

tomy of the inferior oblique aided materially in relieving the slight upward turning, which is the accompaniment of so many cases of convergent squint.

In locating the muscle or muscles responsible for the spasm of the inferior oblique, it is necessary to separate the cases into two classes: those in which diplopia can be elicited, and those in which it cannot. When the patient can recognize the two images, the study of the field of binocular single vision will in most cases reveal the true nature of the anomaly. Duane's tangent plant cannot be improved upon for this purpose. I should like to emphasize one or two points in its use, which I have found helpful. The assistant who steadies the patient's head also holds the red glass, which I have fastened to a pointer about eighteen inches long. Holding the glass in this way makes it easier to keep the plane of it always perpendicular to the visual line as the gaze is shifted. I have also placed a black pin in the square which marks the limit of my own field in the six cardinal directions, for the purpose of having always a fixed point from which to measure the displacement of the images. It facilitates the making of the test, and I believe increases its accuracy.

When diplopia cannot be recognized by the patient, a careful study of binocular rotations should be made objectively. While critical observations of the corneal images is essential to the proper study of the associated movements of the two eyes, I have found that it is sometimes easier to estimate the amount of lagging or upshoot, by observing the width of sclera showing between the lower limbus and lower lid margin when the eyes are elevated, and the estimated width of the cornea which has disappeared beneath the lid margin when they are depressed. This test should be applied routinely in the study of every case of squint of whatever form. The cover test applied in other positions than the primary one will frequently furnish valuable information. One of my cases of convergent squint, when tested with the head turned to the left, showed a deviation with the cover test of 50°, and when turned to the right but 40°, showing a greater weakness of the right lateral rotations than the left, and this, despite the fact that the tropometer showed equal temporal rotations, tho subnormal. This difference was confirmed when the angle of the squint was measured on the perimeter.

The tropometer or perimeter when used to measure the monocular field of fixation in degrees gives helpful information. Quite as much stress, however, should be placed upon the facility with which the eye makes its rotations, as upon the actual number of degrees covered. Its weakness lies in the fact that it does not measure the verting power of any one muscle but of several, and for that reason it seems to be of more value in its application to the lateral than to the vertical recti and obliques. I have had the indicator on my instrument fixed so as to permit of oblique rotations, but the readings are difficult to make, and I could never satisfy myself that they gave me much added information. Unless there is a margin of difference of 5° in the corresponding rotation of the two eyes, I do not place much reliance upon the findings. However, it is only fair to say that its value in diagnosis is greatly enhanced when used as a supplement to the study of the binocular rotations.

Finally, in diagnosing a spasm of the inferior oblique, it is well to bear in mind the possibility of a too high insertion of one of the interni. The late Dr. Todd, in a letter to the writer, brought out this point. I do not remember ever having seen it published. If the upshoot occurs when the eyes are rotated laterally and in the upper fields, and not in convergence, there is in all probability a spasm of an inferior oblique. On the other hand, if the upshoot persists when the eyes are in extreme convergence, a malinserted internal rectus should be suspected. Since we know that not all cases of squint are caused by an impaired or absent fusion faculty or ametropia, we are confronted with the problem of determining what muscle or muscles, by their faulty action, are disturbing the coordination of the two eyes. I am

convinced, since studying some of my cases of squint more carefully, that I have greatly underestimated the role that paresis of the superior rectus plays in the etiology of certain types, and that a thoro search will frequently reveal the offending muscle.

If these cases are seen late—after contractures have taken place—it becomes increasingly difficult to make a correct diagnosis, and we are then confronted with the necessity of meeting conditions as best we may. In cases of either convergent or divergent squint, if there is a definite upshoot of one eye when both are rotated to the opposite side, I believe we are justified in tenotomizing the inferior oblique of that eye to aid the lateral adjustment, even tho we cannot demonstrate to our entire satisfaction a paretic superior rectus or superior oblique, and provided, of course, that the convergence test shows no malinserted internus.

Some operators prefer to advance the paretic superior rectus rather than tenotomize the inferior oblique. Theoretically, it is probably the better procedure, but from a practical standpoint I believe that it is very much easier to tenotomize an inferior oblique than to advance a superior rectus.

It seems to me, however, that the decision as to which operation we should perform rests upon other factors than ease of performance. If the individual upon which we propose to operate can fuse, even tho in a limited field, then I believe we should attempt to strengthen the weak muscle by an advancement rather than weaken the spastic one by a tenotomy. With the exception of a limited number of cases of divergent squint, the majority of the operable cases have never been able to fuse in any field, by reason of the peripheral obstacle to fusion which has existed. For this reason we are entirely justified in tenotomizing the inferior oblique, a much simpler procedure than an advancement of the superior rectus. Even in these cases it becomes necessary sometimes to advance or tuck the superior rectus, after having tenotomized the inferior oblique, in order to correct the vertical deviation in the primary position. While it is true that a tenotomy will abolish the upshoot of the eye, I have not been able to secure a vertical correction of more than 3° (arc) in the primary position. This is about what we might expect, if we accept Maddox's statement that the elevating action of the inferior oblique in the primary position is only 30% of the total.

There is one phase of the surgery of the inferior oblique which always has seemed to me to be a violation of a surgical principle when applied to an ocular muscle; namely, the complete severance of its tendinous origin in the superior maxilla. We know when tenotomizing one of the recti muscles that even tho we completely sever its attachment to the globe, we can rely upon the check ligaments and the lateral expansion of Tenon's capsule to limit the effect of the tenotomy.

A tenotomy of the inferior oblique, however, calls for a severance of the tendon at its origin and not insertion, and so far as we know there are no fascial slips to hold the muscle after it has been released from its attachment to the bone. White reported one case of double origin in an oblique, but this must be regarded as an anomaly.

It seemed to me, that if we could lengthen the tendon at its origin by a series of cross cuts, such as has been suggested by Harman and later Todd for the recti tendons, we should be able to weaken the muscle sufficiently to accomplish our purpose without completely disabling it, allowing it to run wild and hoping that it would reattach itself somewhere.

On the last case which was operated upon, this was done. After the incision was made in the orbital septum, close to the bony rim of the orbit at the lower end of Terrien's line, the tendon was isolated on two small Stevens' hooks, and three cross cuts made as close to the point of origin of the muscle as possible. Obviously, since the tendon is but 2 mm. long, part of the cutting was done in muscle tissue. Of course, since there is no globe upon which these cut fibers can rest, and to which they become attached by scar

tissue as they do when a rectus tendon is lengthened, we must hope that sufficient scar tissue will be formed to support them and prevent them from tearing apart. However, even if they do this, we are in no worse plight than if we had deliberately performed a tenotomy in the first place.

Duane's article, describes fully the technic of the operation, and I shall not go over that ground except to emphasize one or two points. Whether the operation is performed under local or general anesthesia, complete hemostasis of the subcutaneous and orbital tissues adjacent to the operative field is very important. After the skin incision has been made and the muscle fibers separated down to the orbital rim, Meller's tear sac speculum will greatly facilitate the subsequent steps of the operation.

The opening in the orbital septum should be made carefully, as the tendon lies in close proximity to it and may be cut by a too free incision. In some cases, portions of orbital fat protrude, but while annoying this does not seriously interfere with the isolation of the tendon. Traction of the tendon rotates the eyeball up and out, and extorts the vertical meridian, illustrating beautifully the action of the inferior oblique muscle when acting by itself. An intracutaneous suture of fine black silk will reduce scarring to an almost negligible amount.

BIBLIOGRAPHY.

1. Duane. Archives of Ophthalmology, Vol. XIV, No. 1, 1916.

HETEROPHORIA.

L. Webster Fox, M.D., LL.D.

Professor of Ophthalmology, Graduate School of Medicine University of Penna.

Philadelphia, Pa.

The later observations bearing on heterophoria are here summarized. Some of the most important published in America have not before received adequate attention in ophthalmic journals; as those on the normal movements of the eyes as studied in the laboratory. Read to open a discussion on heterophoria in the Section of Ophthalmology in the British Medical Association, Glasgow, July 27, 1922.

When the array of phenomena incidental to incoordination of the extraocular muscles was presented to the medical profession under the term "heterophoria," there was opened up a field for discussion and speculation the limit to which seems nowhere in sight. Like Mark Twain's remark concerning the weather—"a lot has been said, but nothing done about it!" As we all know, it is to the late Dr. George Stevens of New York City that we owe a debt of gratitude for this term and the others of the phoria group, for it is by reason of this nomenclature that a proper appreciation of these functional disturbances was obtained. The previously existing chaos of terms naturally led to a chaos of understanding. Unquestionably the condition had been recognized and treated successfully in individual cases, but the problem of disseminating this information was complicated by the fact that no one observer knew what the other one was talking about.

To the psychologist, the problem of the two images seen by the two eyes appears to be settled. It may be, as Hering long ago said, the eyes are a single organ with two limbs, and also that the duality of the eyes is necessary for stereoscopic vision, but at the same time the philosophic skeptic marvels at the absence of double vision and stereoscopic vision when the extraocular muscle balance is disturbed in any given patient. The patient suffers instead from dizziness, nausea, and vomiting. Binocular single vision in the presence of orthophoria is difficult enough to explain properly, but binocular single vision in the presence of heterophoria requires all the attention of the physiopsychologist to elucidate. The creation of these reflex symptoms,

already referred to, in the presence of heterophoria argue for a closer association of the extraocular muscles system with the entire physiology than is generally admitted, even among the most zealous exponents of this relationship. It is conceded that the nervous system, and especially the sympathetic, is directly involved, but from then on the relationship of heterophoria to the general human physiology is left to take its own course.

The unlimited variety of terms coined in connection with the transitory impairment of function of the extraocular muscles, and the muscle incoordination that accompanies such changes, and the still greater—if such were possible—explanations of the phenomena brought out by the countless precision tests in this connection, leave the poor searcher after truth in a bewildering maze—and still heterophoria continues to develop, and even persist in the patients that have been the subject of these tests and observations.

In the Oxford Ophthalmological Congress of 1921, Ernest E. Maddox, in the course of the Doyne Memorial Lecture, elucidated the condition, in the manner of the master that he is, and doubtless will be unconsciously quoted from time to time in this paper. Buried in a maze of physiologic data, he casually mentions the fact that the link between convergence and accommodation enables us to influence its slackness (called "exophoria") by spherical lenses, a treatment that next to constitutional measures is the best. For exophoria he uses full correction of hypermetropia; for esophoria, partial correction; but not always, for in neurasthenia a full correction may be the best. For many years he has treated exophoria in healthy young people by concave lenses, so as to stimulate accommodation and create better convergence.

Herein lies the entire subject of heterophoria. The diagnosis is fairly well worked out—the explanation never will be (there are too many explainers)—but the treatment can be, as the very complexity of the condition speaks for its close relationship to the general health. It may be regarded as a form of neurasthenia.

One cannot help being impressed by the statement, that however great the postural defect may be, if compensatory hypertrophy has made the fusion reflex great enough to overcome it easily, the heterophoria may be regarded rather as a harmless anomaly than as a pathologic symptom. The trouble begins when compensation fails to be completely obtained. There are many psychic factors that effect fusion. Sir James W. Barrett[1] reports a case in which there was voluntary control of fusion. The patient could move either eye outwards separately or together, but he could not effect vertical disassociation. W. Rumbaur[2] reports a girl who could squint voluntarily. She could adduct each eye separately, and again she could fix one eye in adduction and then turn the other horizontally. With this remarkable accomplishment she showed two degrees of exophoria compensated for by glasses. Why should she have had any? This case points not to an abnormally strong innervation impulse, but rather to a voluntary inhibition of normally associated innervation. Another example may be mentioned of the popular moving picture actor, Ben Turpin, who has capitalized his ability to rotate one of his eyes at will while the other remains fixed.

Coming back to the original thought, when the images seen by each eye are alike in shape fusion is facilitated, but with the Maddox rod, for instance diplopia will be developed that probably did not exist for practical visual purposes. Again, with the Maddox rod in the horizontal position, the line of light will not only be to one side of the light but may be above or below the light, yet when the rod is turned so that the streak is in the horizontal plane, it will be found to be in the same plane as the light. Also, in the measurement of the strength of the muscles with prisms before one eye, it will be repeatedly found that the muscles will overcome a stronger prism base down before the right eye than base up before the left eye, and that nearly always the left eye will over-

come a stronger prism base down than base up, yet orthophoria will be found with the Maddox rod in a whole group of cases showing varying peculiarities of this character. Doubtless many explanations can be advanced for these phenomena, nearly all of which will be correct, depending upon how far we go into the subject. The shorter the distance we go, the better able are we to grasp the big comprehending truth that the compensation is effected by a host of factors embracing the whole domain of human physiology, and that it is never constant or static.

Maddox very nicely sums up the treatment of heterophoria. He advises first discovery of the cause and its removal. Then examination of the refraction and the correction of ametropia. If lateral and vertical deviation exist together, which they frequently do, he corrects the vertical and ignores the lateral. Next he prescribes muscle training and prism exercise, and last of all muscle operation(graduated tenotomies).

Since heterophoria is, after all, only the latent disturbance of the extraocular muscle coordination, it is well to refer to the work done in recording the movements of the eye in the discharge of their normal function of reading. C. Sheard, in the *American Journal of Physiological Optics* (April, 1921), reviews the work in this phase of muscle physiology, and it is well worth a pause to relate some of the facts that he has brought together. Thus the fact, first brought to the attention of ophthalmologists by Javal about 1879, that eye movement, as in the act of reading, is not continuous but rather discontinuous. While many of his inferences drawn from his experiments to prove the above have since been shown to lack substantiation, the principal point, that the eyes steady themselves for each completely focused picture, remains accepted. Landolt concluded after working on this basis, that 1.5 words on the average were read at each fixation. Delabarre, of Brown University, in 1898, attached a recording apparatus to the cornea and secured tracings of the ocular movements. Later Huey, of Clark University, attached a very light plaster-of-Paris cup directly to the cornea, and recorded the eye movements by a system of light beams, which were so arranged in conjunction with suitable electrical devices as to provide a measurement, in very small fractions of a second, of the time used up by an eye in the movements of reading. Quoting Sheard's abstract of this work, the results obtained by Huey showed: (1) In reading relatively long lines of magazines, the average number of fixations is about 4.5 per line. (2) Doubling the distance from the eye to the page does not affect the number of fixations. (3) Minor modifications in the size of type do not affect the number of fixations. (4) The duration of the reading pauses, altho extremely variable, averages about 0.19 second. (5) Fast reading entails fewer and shorter stops or pauses but not faster movements. (6) A short line—for example about 60 mm.—makes possible fewer pauses relatively, so that more is read with a single pause. (7) The movements forward—that is, from left to right—are quite constant at 0.042 to 0.048 second. (8) The movement of return—that is, from the right end of the line to the left end of the next line—are quite constant at 0.051 to 0.058. Sheard adds the comment that these generalizations are incorrect in that they are too low. Our comment would be that they seem to indicate that accommodation has little or nothing to do with binocular fixation and binocular fusion.

Erdman and Dodge, in 1908, added some observations on this subject, and among their conclusions is the statement that of the entire time spent in reading, from 12/13 to 23/24 is devoted to pauses and the remainder to reading, and that during the pauses it is extremely doubtful if anything is perceived.

Dodge, in 1900, at Wesleyan University, had perfected a method of recording the eye movements, by which he showed that the speed of the forward movements averaged about 1/25000 of a second, while the speed of the return movements was of the order of 1/40000.

Dearborn, using Dodge's method at the Columbia University in 1906, further substantiates his observations and adds some of his own, which constitute perhaps the latest information on the subject. It is of interest to know that the duration of the fixation pause is, roughly speaking, one-fifth of a second; thus, in reading a newspaper column, four readers averaged 161, 216, 255, and 402 thousandths of a second, respectively. The duration is therefore different with different readers, as would naturally be expected. Again, fixation is not absolute and constant, but only approximate—in other words, the eye often makes slow changes of position during a fixation. If these physicists are correct, then heteropheria is more or less constant in every individual during reading, altho its quantity is extremely variable within short ranges of time. Again, its degree must vary with each of these fixation pauses, yet our means of determination and expressing heterophoria have to do with the eye in repose and fixed at a distant point of no practical importance, or occasionally at some definite target at a definite close point, in neither case approaching the practical conditions under which the eyes are used day in and day out. It is most remarkable in the circumstances that we do as well as we do in the handling of the treatment of heterophoria.

These observations of Dearborn, ably interpreted by Whipple of Cornell University, prove conclusively that we have far to go in the subject of heretophoria before we can reduce the phenomena to hard and fast rules of practice. Fixation pauses were shown, for instance, to be more frequent than is needed for clear seeing of the stretches read, as is shown by the fact that they remain the same in number when the print is removed to a double distance from the eye. This would seem to belittle our time hallowed belief in the accommodation-convergence relationship. Fatigue, Dearborn insists, causes a slower rate of reading and a gradual decrease in the velocity of the eye movements. We venture the inquiry as to whether the multiplicity of the steps and the readjustments is not the cause of the fatigue, not the prolonged accommodative effort.

If fixation is so frequent, then must our observation be made with greater frequency in order to determine what the normal average variation is for each patient. Many careful examiners now do, and all should, measure the socalled muscle balance of every patient at each examination of the refraction, retaining such records for such time when symptoms of muscle asthenopia appear. In passing, comment is made of the term extraocular muscle balance; there is no such isolated condition—the intraocular and extraocular muscles at all times have an interlocking relationship.

The recitation of these points may impose on the good nature and patience of the members, but they are mentioned in order to prepare you for the reception of the writer's own views a trifle later on.

Now in order further to confuse our knowledge of ocular movements, E. Ruggeri[3] gives us tracings showing the marked effect under certain conditions of extreme convergence. The reclining patient is made to gaze at the forefinger held 1 cm. from the tip of the nose, and then tracings of the pulse are taken. In the numerous normal subjects it was not disturbed, as would naturally be expected. In multiple neuritis, from malaria, diphtheria, or influenza, the pulse ran up at once from twenty to thirty beats; in thyroid dysfunction, from twenty-five to thirty. In other cases it was negative. By strange coincidence it is in these latter groups of patients, who have recently had these conditions, that our heterophoria patients occur.

The great criticism that obtains in all our work is the scarcity of observations made upon healthy normal individuals without symptoms. The late war afforded much material for such valuable observation. James N. Buchanan of Freeport, Illinois[4], while working in the Medical Research Laboratory, Hazelhurst Field, Mineola, Long Island, N. Y., made a detailed study of the examination of the extraocular muscles in fifty-one air pilots and observers, and three nonfliers who had served successfully as airmen overseas. Seven of these subjects, of whom five were fliers, were

found to have qualifying heterophoria. The tabulation of these results and the method of examination is worth reading. One of his observations is notable—that with two exceptions every determination of convergence, divergence and sursumduction by the descending method of using prisms is less than the corresponding one taken by the ascending method. This is to be expected, as the individual has been accustomed to fusion since childhood and tends to retain it as long as possible in the ascending method. On the other hand diplopia is produced early, and in the absence of encouragement it is more difficult to regain fusion.

A pertinent inquiry arises as to whether the heterophoria is to be accounted before or after these well known phenomena are produced. There is certainly a marked variation in the degree present before diplopia has been artificially produced, and after the same has taken place.

The conclusion to be drawn from these apparently disconnected observations is, that heterophoria is a constant accompaniment of binocular single vision, altho not always symptom producing, and that even tho constantly present varies considerably in each individual patient and is extremely fluctuating in amount.

The question naturally arises as to what factors are necessary to cause the more or less constant heterophoria to assume a pathologic significance, or, in other words, when is it symptom producing. We may quote from many authorities or fall back on our own experience for the answer, and state that such conditions as devitalize the muscles and nerves in general are responsible, and then under this head, fatigue and exhaustion in general; and then fatigue and exhaustion of the eye muscles from overwork and the presence of an insufficiently corrected ametropia, anemia, nervous prostration, malaria, influenza, diphtheria, typhoid fever, nephritis, diabetes, and similar disturbances. All these will assist materially in expressing a pathologic heterophoria. Faulty attachment of the muscles and congenitally weak muscles may cause heterophoria, but it is doubtful—heterotropia results therefrom as soon as the eyes are used to any extent in efforts at binocular single vision. In point of fact, heterophoria, being latent, is always overcome; therefore congenitally weak muscles, being present from the very beginning, are compensated for at the start, if at all, and the patient is adapted to the change from the very start of binocular single vision in infancy. Consequently we cannot accept such causes as refer to anatomic distribution, disturbance of innervation, spasm or paresis of the muscles. If these causes have failed to produce heterotropia, they are of no moment. It is, rather, an effort to maintain a physiologic process in the presence of exhaustion of the parts concerned that induces the symptoms.

These symptoms are never constant and continuous; they are always periodic, depending upon the patient and the circumstances of his or her work. Therefore we cannot help but assume that the cause is likewise of a periodic character.

To Stevens and to Maddox and Duane we are indebted for most of the tests and determination of the varieties of the condition, and these are well known to every practising ophthalmologist. The symptoms given in the books are correctly stated, and when in the course of routine examination of the refraction we discover heterophoria, its treatment should be considered, but not necessarily by the use of prisms and graduated tenotomies.

In a recent number of the *American Journal of Physiological Optics* (April, 1922), it is refreshing to read the views of a veteran in the matter of prisms and their uses. Charles F. Prentice, in an article in this number on the "Lateral adaptability of the extrinsic muscles in ametropia," gives us considerable practical advice as the results of his long experience in the use of prisms in heterophoria. One of his conclusions was that most persons for whom lateral prisms had been prescribed did not usually revisit him, whereas those patients who had been given vertical prisms did return for subsequent examinations and commonly expressed great satisfaction respecting the comfort they had derived from them. It is therefore his opinion, on an experience of forty years' prac-

tice, that the use of prisms for the attempted correction of lateral muscle imbalances only retards recovery. This it will be noticed corresponds in large part to the statement of Maddox, quoted again in this article: "if lateral deviations are complicated by hyperphoria, correct the vertical deviation first and the lateral will very likely correct itself."

Returning to the symptomatology of heterophoria, one of the greatest symptoms of the condition is a failure of the patient to obtain perfect comfort and relief from glasses recently prescribed for asthenopic phenomena, that are to all intents and purposes correctly prescribed. The great cause of uncomfortable glasses is an uncorrected heterophoria, usually a hyperphoria, or an artificially created heterophoria as the result of imperfectly centered lenses or overcorrection. This is more especially true when bifocal lenses have been ordered. Many older people have corrected their own heterophoria by grotesque twistings of their reading glasses, causing much mirth and merriment to the onlookers, and evoking pity that they should be ruining their eyes in this manner. Such persons have greater difficulty in wearing the correcting lenses properly centered if the heterophoria correction is not incorporated in them.

De Schweinitz and others have emphasized the point, to which I agree, that the measurement of the relative weakness should be made after the correction of the refractive error has been made, and that the muscles should be tested thru correcting lenses; and again, that the examination of the muscles should be made for six meters and thirty centimeters.

The treatment I prescribe is orthodox. Rest of the eyes and rest of the whole body is essential and desirable, and consideration of its great value should render it practical, altho frequently regarded as impractical and impossible.

It is presumed that the careful ophthalmologist always makes complete tests of the condition of the extraocular muscle balance in the course of routine examination of the refraction, but it is to be regretted that this presumption fails of realization; or else it is a failure to interpret the findings obtained, since patients go from one office to another with distressing symptoms, essentially eye symptoms, that can be accounted for only by muscle trouble and relieved by treatment directed thereto.

S. Weir Mitchell years ago demonstrated in connection with headache and eyestrain, that it was the minor errors, capable of being overcome by muscular effort, that caused the more severe headaches and nervous symptoms; those that could not be overcome caused only one symptom—defective vision. So it is with heterophoria, the minor degrees are the trouble makers.

In commenting on the importance of heterophoria tests in routine refraction, H. H. Briggs of Asheville, N. C.[5], gives a good description of the series of tests he employs, including tests for accommodation, absolute and relative, tonicity of the muscles, cover test, convergence, accommodative convergence and fusional convergence, amplitude of convergence, duction, version, cyclophoria, and field of fixation. With the necessity of these desirable findings in mind, one may avail himself of a host of tests that will determine for him the exact status of the muscle system of the eye. The great fault usually is that the examiner does not know exactly just what information he should have, and if not wide awake goes thru a number of tests in a perfunctory manner, and to him as meaningless as to the patient.

Latent hyperphoria (a variety of heterophoria) will often produce a persistent accommodative spasm, as is well shown in a paper by F. W. Marlow of Syracuse, N. Y.[6], which, among other things, explains why some patients will not take their full ametropic correction. He sums this up in one sentence, to wit: "any excessive muscular effort necessary to bring the visual axes into parallelism may induce accommodative effort in excess of that necessary to maintain clear vision." He has observed, as have many others, more than one case in which at the postcycloplegic examination the patient would not accept the full correction, that the placing of prisms in the trial frame to correct wholly or in part the manifest heterophoria will at once raise the vision or permit the acceptance of a stronger lens. Many others have had similar experiences, and have

profited by their interpretation of this phenomenon.

The treatment of heterophoria is always individual—it is most difficult to group the cases for this purpose. In a recent editorial by Edward Jackson of Denver, Colorado,[7] concerning orthoptic training, the statement is made:

"The mechanism of our ocular movements does not enter our consciousness. We are conscious of results attained and a sense of effort to attain them. The changes that intervene and bring about these results are subconscious. But the effort must be made; and the *movements guided by their effect on vision.* All forms of orthoptic apparatus (and training) depend for their usefulness on the presence of a fusion sense. But whether this sense is strong or feeble, real exercise is possible only by the patient making an effort."

Those of us who have struggled to attain binocular single vision in any case of anisometropia, after bringing the almost amblyopic (from disuse) eye to normal vision, can well appreciate the force of Jackson's remarks. Here we have a pure case of heterophoria, yet, if the patient be an adult, we all know the great difficulty the patient will have wearing the lens prescribed.

In a marked case of heterophoria with severe symptoms, a long period of atropin cycloplegic will go far towards effecting a cure. Unfortunately, we are so frequently compelled to rely on drugs whose period of cycloplegia is of short duration. Electricity has been highly recommended by some observers, but it should be remembered that the commonplace treatment of "rest" is the one thing that restores all overworked muscles, no matter what their situation; and also it should be remembered in this same connection that only overworked and exhausted muscles go into cramp and spasm. After all, that is all that *rigor mortis* is!

In prescribing glasses the point made by de Schweinitz should be borne in mind, and the correction so calculated that the muscle balance is perfect at the distant and near point most practicable for the individual's particular use. The esophoria or hyperphoria should be eliminated for these points, whether accomplished by decentering the lens or incorporating prisms. Often a six or seven degree prism base down or up, when correcting lenses are used and a reading card or astigmatic dial employed in obtaining the correction, simmers down to one, two, or three degree prism, and comfort follows its use; whereas discomfort follows the higher numbered prism obtained by other apparently more precise tests. I correct as low as one degree hyperphoria and three degrees esophoria when determined in this manner.

Prism exercises have the stamp of authority for their recommendation, but patients are reluctant to stick to them, and their results are correspondingly good or bad, for the reason shown in Jackson's editorial.

REFERENCES.

1. Medical Press, April 6, 1921.
2. Klin. M. f. Augenh., 1921, v. 66, p. 927.
3. Riforma Medica, v. 36, p. 1029.
4. Trans. Amer. Acad. Ophth. and Oto-Laryngol., 1920, p. 104.
5. Trans. Sec. on Ophth. A. M. A., 1922.
6. Archives of Ophthalmology, May, 1922.
7. American Jour. Ophth., April, 1922.

TRANSFER OF FUNCTION OF OCULAR MUSCLES.

EDWARD JACKSON, M.D.

DENVER, COLORADO

The possibility of executing a movement with muscles not used hitherto for that purpose is pointed out. The methods by which this can be used in ophthalmology are given, for ptosis, paralyses of the superior oblique and external rectus and oculomotor palsies. The general conditions of success are considered. Read before the Utah, Colorado and Wyoming section, American College of Surgeons, Salt Lake City, Monday, September 11, 1922.

Purposive movements are executed by nerve centers, acting thru such muscles as they have at command. The "pithed frog" irritated on one side of his back moves a leg of that side to scratch away the irritant. But if prevented from doing this, it innervates the muscles of the other side to accomplish the same purpose by using movements of the other limb. A man can write his signature with arm and forearm fixed, by moving only the fingers. But he can also write his signature, with fingers, wrist and elbow held absolutely rigid, by movements at the shoulder. In the one case the writing is done with the muscles of the forearm and hand acting on the fingers; in the other by a totally different set of muscles of the upper trunk acting on the upper arm. Yet in either case the signature will be individual and characteristic.

In general there is some range of choice as to the muscles used to accomplish a certain purpose. Operative transfer of function from one muscle to another is possible, and offers a remedy for defects of movement that cannot be overcome by nerve impulses acting thru the usual channels. The movement produced by the contraction of a muscle is determined by the position of its insertion; and for many muscles it is possible by operation to change somewhat the insertion, and thus, to a certain extent, the function of the muscle. This is peculiarly true of muscles that produce rotation of ball-and-socket joints, and preeminently true of those that act upon the eyeball.

The recti muscles arise at the apex of the orbit by what is practically a common origin. Their tendons of insertion wrap around the eyeball near its equator to be attached to the anterior segment, where their insertions are clearly visible and readily accessible. Their functional performance can be exactly measured, so that previous condition and ultimate result can be accurately known. Lessons can be drawn from careful work on these muscles that should be instructive and suggestive with regard to the transference of function among muscles acting on other parts of the body. This is especially true in this formative and pioneering period with regard to operations to replace and supplement lost muscle function.

The oldest operations of this class are those for correcting ptosis of the upper eyelid, by connecting the lid with the broad fascial insertion of the occipitofrontalis muscle. Dransart[1], in 1880, described his operation of using buried catgut sutures, connecting the tarsus of the upper lid with the frontalis fascia and muscle, under the eyebrow. In 1881, Pagenstecher[2] used silk sutures to connect the lid and frontalis; tied in bow knots over gauze or tubing, to be tightened from time to time until they had cut out, leaving bands of cicatricial tissue to connect the lid with the frontalis.

The results so obtained were good for a time, but not permanent. Dehenne[3], to get a more lasting effect, used catgut hardened in naphthol. Mules[4] used a buried suture of gold wire, intended to remain permanently. Worth[5] placed a double, rather elaborate stitch of kangaroo tendon. Harman[6] substituted a delicate gold chain, as being less stiff than gold wire. De Wecker[7] and Landolt[8] combined with sutures the ancient plan of exercising tissue that appeared redundant. Panas[9] used a flap of skin from the lid, which was drawn thru a tunnel under the eyebrow and sutured to the frontalis above the brow. This has been followed with modifications by Allport[10], Tansley[11]

and Grimsdale[12]. Darier[13], Fergus[14] and Roberts [15] took tongue like flaps or slips from the frontalis, which they sutured to the skin of the lid or to the tarsus. Angelucci[16] and Sourdille[17] divided the tendon of insertion of the elevator of the upper lid and attached it to the peripheral portion of the frontalis.

A certain measure of success has rewarded all these efforts to make the frontalis do the work of the elevator of the upper lid. Raising the lid is a normal secondary function of the frontalis muscle. Its influence in this direction can be easily demonstrated by pressing the edge of the hand against the brow and making a strong effort to raise the lid. The socalled elevator of the lid and the frontalis cooperate to raise the lid. When the former is disabled, one of the above operations may be done to enable the latter to perform more efficiently this function of raising the lid.

An elevator of the eyeball, the superior rectus muscle, does not normally assist the elevators of the lid; but it acts in very close association with them. When the eye is turned up, the upper lid is raised with it. When the eye is turned down, the lid is allowed to fall. In 1897, Motais[18] described an operation for relief of ptosis caused by paralysis or weakness of the elevator of the upper lid, by attaching part of the tendon of the superior rectus to the tendon of the lid elevator, close to its insertion upon the tarsus. The tendon of the superior rectus is exposed by an incision passing back to the fold of transition between the eyeball and upper lid and a tunnel made thence in the upper lid external to the tarsus. The middle third or half of the rectus tendon is isolated, by incisions parallel to its fibers, and cut loose from the eyeball at its insertion. Two sutures introduced thru this transplant are passed between the tarsus and skin of the lid nearly to the lid margin and brought out on the skin surface. By these the tongue of rectus tendon is drawn into the tunnel in the lid and secured there.

O'Connor[19], who reports six cases, believes that "this should always be the operation of choice where any power of upward rotation (no matter how small) of the globe is retained." He followed the technic as described by Beard[20], who had done the operation 16 times. Beard says of these; "The results, in all of them, are far and away the best I have ever obtained in this affection." Beard also wrote: "The manner in which the free border of the upper lid keeps out of the way of the pupil, as the subject looks further and further upward is truly beautiful to contemplate. As regards annoying diplopia, upward squint, inability to keep the lids closed during sleep, etc., I have not observed any of these." The results of the "Motais operation" have been satisfactory and generally permanent. Aranquez[21] modified the procedure of Motais by isolating and dividing the tendon of the elevator of the lid; and suturing the distal portion of the elevator to the tendon of the superior rectus muscle, which has been left intact. Bruns[22] has reported a case of Motais operation seen 13 years after operation, in which the relief was complete, remaining the same as it was a month after operation. The writer[23] has seen a case 6 years, and again nearly 14 years after doing a bilateral operation. There was full and permanent relief. Jocqs[24] reports a case seen 20 years after a Motais operation for ptosis due to injury to the lid. A partial return of the drooping of the lid was apparently due to the effort to escape diplopia, which appeared when the pupil was uncovered by the operation, but which finally disappeared.

PARALYSIS OF SUPERIOR OBLIQUE.

The fourth cranial nerve, supplying only the superior oblique muscle, is frequently involved in trauma by blows on the head, or falls, striking on the back part of the head, as well as in other lesions that cause palsies of the cranial nerves. The muscle, arising from the common tendon of origin at the apex of the orbit, has its direction changed by the pulley so that it passes backwards and outwards over the eyeball, to be attached to the temporal posterior part of the sclera. Its

contraction exerts the most manifestly varied effects on the position of the eyeball. If the visual axis is turned strongly toward the median plane, the superior oblique turns the eye (the cornea) down. If the visual axis is directed strongly to the temporal side, the superior oblique acts almost wholly to produce wheel rotation about the visual axis, intorsion of the eye. In conjunction with the inferior oblique, it also tends to turn the eye out, and this tendency increases the more the eye is turned out.

Paralysis of the superior oblique therefore limits the turning of the eye down, its intorsion and its ability to turn to the limits of the temporal field. Naturally the attempts made to remedy such a complicated condition of affairs, by simple tenotomy or advancement operations on the recti tendons, yielded very unsatisfactory results. The muscle which cooperates with it to turn the eye down is the inferior rectus, but this opposes it in wheel rotation, and in the lateral movement of the eye. The inferior oblique assists in turning the eye out, but opposes it in superior wheel rotation and in vertical movement. The superior rectus, while opposing the oblique in vertical and lateral movements, assists it in wheel rotation; and tenotomy of the superior rectus, done to lessen the vertical diplopia in the lower part of the field of fixation, generally so impairs the wheel rotation (intorsion), that the last condition of the patient is worse than his first.

In 1903, the writer[25] described transplantation of the superior rectus for paralysis of the superior oblique. The insertion of the superior rectus is placed more posteriorly, as tenotomy would displace it, lessening the tendency to vertical diplopia on looking down. But the insertion is also moved to the temporal side of the sclera, where it can exert more influence to cause intorsion and thus make up for this part of the weakness of the superior oblique.

The technic of the operation closely resembles that of an advancement; but the tendon of insertion, instead of being brought forward, is displaced toward the temporal side and backward. The effect as regards upward movement is similar to that of a tenotomy, but as to wheel rotation it is that of a true advancement.

The results of this operation have been satisfactory and permanent. Case 1 was seen after 14 years, when there was exophoria 1 centrad, hyperphoria 0.5 centrads, and no cyclophoria. Another case operated on in 1906 has been seen within a few weeks, with apparently perfect muscle balance about the center of the field of fixation.

PARALYSIS OF EXTERNUS.

In 1907, Hummelsheim[26] reported relief of congenital paralysis of the external rectus by attaching to it temporal portions of the tendons of the superior and inferior recti. He first tried the operation experimentally on a monkey. By exsection of the external rectus all power to abduct that eye was abolished. He then did his operation of transplantation and restored a large part of the abduction. Then he operated on his patient, a girl of 12, and secured 30° of abduction, where before the eye could not be turned beyond the median plane. The operation[27] includes passing a strabismus hook under the tendon of the superior or inferior rectus to get the full width of the tendon, dividing the tissue along the temporal margin of the tendon for 15 mm. back from its insertion, splitting the tendon and muscle along the median line for 12 mm. back from the insertion, and dividing the temporal half of the insertion. The slip thus separated is sutured to the tendon of the abducens, as near to its insertion as possible. So far as is practical the operation is done within Tenon's capsule to avoid postoperative adhesions.

This operation has been rather widely tested, especially in this country. In 1912, Stuelp[28] reported its use with tenotomy of the internus to relieve convergent squint from complete traumatic paralysis of the external rectus. In 1917, Woodruff[29] reported two cases in patients of 20 and 7 years of age. He sutured the tendon slips from the superior and inferior recti to the externus tendon with formolized catgut.

Turner[30] used ten day chromicized catgut. In discussing Woodruff's paper, cases were reported by Todd, Tenner and Wiener. Two years after operation, Crossley[31] exhibited one of Woodruff's patients, the fourth so operated on by Dr. Woodruff. Sweet[32] has reported a case.

O'Connor[33] modified the operation by splitting the externus tendon into three segments. To the upper the slip from the superior rectus was sutured by a mattress stitch; and similarly the slip from the inferior rectus to the lower segment. The middle segment was shortened by his "double hitch method." In detaching the slips from the superior and inferior recti, he has included with them related portions of the capsule of Tenon. He reports two cases, in one of which he got a good and in the other a perfect result. Peter[35] reported a case operated on by O'Connor's method, securing outward rotation of 50°. He suggested that the external rectus should be advanced and the overlapping tendon split, the parts turned up and down and the transplants from the superior and inferior recti attached to them. O'Connor[36] subsequently reported his results in 7 cases. These were all satisfactory except that in one no outward rotation was secured, altho a convergent squint was corrected; and in another there was failure to change the condition present.

OCULOMOTOR PALSIES.

After the possibility of replacing the external rectus by slips taken from the adjoining muscles and tendons had been demonstrated, it was natural to try the same method on the other recti muscles. In 1912, McDanald[37] reported a case of left sursumvergence due to congenital absence of the left inferior rectus. He did tenotomy of the left superior rectus; and split the tendons of the internus and externus each about in half and reattached the lower strands to the sclera below the cornea in the region where the inferior rectus should normally be inserted. Increased comfort of the patient from this operation was reported.

A case is reported by Posey[38] in a young man, the left side of whose face was underdeveloped, with the left eye fixed horizontally, the right eye deviated strongly upward. The right eye could not be moved down and out, altho it could be turned by the superior oblique somewhat down and in. The inferior rectus was found to be absent, except a very rudimentary portion at the usual site for its insertion. To this the lower halves of the internus and externus tendons were sutured; and a free tenotomy done on the superior rectus, care being taken to bring forward, as much as possible, the lower part of the capsule of Tenon. At the end of two weeks the eyes were directed on the same plane and there was a left hyperphoria of 10°.

O'Connor[20] reports a case in which there was complete paralysis of the left superior rectus with blindness from gunshot wound of the orbit. The internal and external recti were split, and their upper halves transplanted upward and sutured to the margins of the insertion of the tendon of the superior rectus with a "cinch shortening" of each transplant; complete tenotomy of the inferior rectus was also done. After 3 weeks the patient was able to turn the eye up 20°. After 11 months the result was still satisfactory.

Complete paralysis of the oculomotor nerve, involving loss of function in three of the recti muscles and the inferior oblique, leaves the eye to the influence of the external rectus and the superior oblique to turn strongly out and down, where it remains almost fixed. Usually there is ptosis, but the deviation of the eye may be noticed thru the closed lid; and if the ptosis is relieved by operation, the squint remains very noticeable and disfiguring. To reduce the disfigurement, division of the muscles still functionally active has been practiced, with such readjustment of the fibrous structures as would tend to hold the eyeball in something near the primary position.

It is possible to so readjust the muscles remaining active as to keep the eye near its normal position, while still preserving a moderate amount of movement. The following operation has been done on the cadaver and

described by the writer, but has not been done on the living patient. It would be somewhat dangerous to attempt on a patient having good vision in each eye, and capable of binocular diplopia. By bringing the image in the deviating eye close to, or upon the macula, but not so that it could fuse perfectly with that of the fixing eye, the annoyance from diplopia might be greatly increased. But with the affected eye so amblyopic that diplopia could not be produced, there would be nothing lost and much that might be gained by such an operation.

The method devised is briefly this: "The superior oblique can be taken up by the method described for tenotomy of that muscle, the tendon isolated, and divided far enough from the pulley toward the eyeball to furnish a sufficient length of tendon, the pulley then cut, the tendon drawn down and toward the eyeball, and the cut end of the tendon sutured to the tendon of the paralyzed internus near its insertion."

"A still better position of the eye, and perhaps a little better movement, may be secured by subsequently splitting the external rectus for 15 mm. back from its insertion, and transplanting the upper portion to the temporal edge of the insertion of the superior rectus, and the lower portion to a corresponding relation with the inferior rectus. It is possible that in a young person a limited field of binocular fixation and stereoscopic vision could thus be reestablished."

From this brief sketch of transplantation of the ocular muscles, it is evident that in the twenty-five years that have elapsed since Motais first described his method for relief of ptosis, such operations have passed beyond the purely experimental period; and are now to be regarded as established procedures, added to our resources, for restoring essential movements of the eyes. A consideration of general facts regarding them should yield suggestions applicable to muscle transplantation in other parts of the body.

CONDITIONS OF SUCCESS.

Our views of transplantation, transference or transposition of tendons have developed from purely mechanical ones to include the biologic and physiologic factors essential to the success of these operations. The permanent nutrition of the transferred tendon must be provided for; and no adhesions caused that will limit or endanger the movements, to establish which operation has been undertaken. The tendons of the recti muscles of the eye share in a blood supply so liberal that danger from interference with it is scarcely considered in planning or executing these operations. Probably it has been too much ignored; but with care it is easy to avoid unnecessary strangulation or exposure of tissue that would endanger the result. The tendons are so thin and flat that their nutrition is very readily sustained by the blood supply of adjoining parts.

The smooth gliding tissue, essential to the smooth free movements sought, is found thruout the whole subconjunctival region, in which the displacement of the ocular recti tendons is practiced. We can scarcely get away from this condition of what Mayer[40] terms the "Physiologic Method of Tendon Transplantation." The subconjunctival tissue conforms closely to Mayer's definition[41] of "paratenon," "a very loose fatty mesh work, rich in elastic fibers, which surrounds the tendon on all sides." The condensed tissue about the tendons as they pass thru the capsule of Tenon, is more nearly like this gliding tissue, than it is like the dense fibrous sheaths that surround tendons in other parts of the body. The only structure in the orbit resembling the dense connective tissue tubes that carry tendons at the wrist and ankles is at the pulley of the superior oblique. If this muscle is to be transplanted, this structure should be dealt with with much the same care as Biesalski and Mayer[42] have shown is essential for such tendon sheaths elsewhere.

Naughton Dunn[43] has pointed out that it is difficult by transfer of a single muscle to get it to take up a function essentially different from the one it has performed; and that it is easier to accomplish this for a whole group of muscles than for a single isolated muscle removed from one group

and associated with another, the latter requiring reeducation. But that such reeducation is possible, at least up to early adult life, without special training is illustrated by what happens after the Motais operation for ptosis. When the eyelids are normally closed as for sleep, the eye is rolled up, so that the cornea is protected by the thick upper margin of the bony orbit. This is a departure from the usual association of action between the superior rectus, an elevator of the eyeball, and the elevator of the upper lid. When the raising of the lid is accomplished thru a slip from the tendon of the superior rectus, the attempt to close the lids is attended with a sudden jerking up of the upper lid. However, this unpleasant effect is temporary; after a time the contraction of the part of the muscle attached to the lid is inhibited and the jerking does not occur. In a young man with congenital ptosis, operated on by the Motais method at the age of 19, I found this undesirable raising of the lid had almost ceased after about 3 months.

When the superior rectus is transplanted for paralysis of the superior oblique, there is merely a reapportionment of functions that the muscle was performing previously. The elevation of the eyeball is diminished, but the wheel rotation about the visual axis is increased. The change of function occurs without any noticeable need for reeducation.

When slips are taken from the superior and inferior recti to replace the externus, it is to make them perform a function by no means foreign to the previous use of these muscles. When the normal eye is turned strongly out, the temporal fibers of the superior and inferior recti help to turn it out. Their transfer to act on the insertion of the external rectus merely enables them to act more effectively in turning the eye out. When the eye is turned strongly down, the lower fibers of the internal and external recti help to turn it down. When these are attached to the insertion of the inferior rectus, they are in position to act more effectively in turning it down. The same is true of using the frontalis to raise the upper lid. Hence in the transplantation or transference of the ocular recti and frontalis muscles, there is little need to resort to means for educating the transferred muscles for the performance of their new function. The redistribution of function that is required by oculomotor paralysis will be more radical, and may require more training and more time to yield its best results.

In general the results of muscle transplantation in the orbit are in close harmony and help to interpret the results of muscle transplantation elsewhere in the body. A comparison of observations and exchange of views on the part of orthopedic and ophthalmic surgeons with regard to muscle transplantation is desirable.

LITERATURE.

1. Dransart. Ann. d'Ocul., 1880, v. 84, p. 88.
2. Pagenstecher. Trans. Internatl. Congress. London, 1881.
3. Dehenne. Bull. et Mém. de la Soc. Franç. d'Opht., 1891, v. 9, p. 83.
4. Mules. Trans. Ophth. Soc. United Kingdom, v. 18, p. 227.
5. Worth. Ophthalmoscope, 1903, v. 1, p. 13.
6. Harman. Ophthalmoscope, 1903, v. 1, p. 137. Brit. Med. Jour., 1903, p. 736.
7. De Wecker. Arch. d'Opht., v. 13, p. 426. Ann. d'Ocul., 1882, v. 83, p. 29.
8. Landolt. Arch. d'Opht., 1897, v. 17, p. 1.
9. Panas. Arch. d'Opht., 1887, v. 6, p. 1.
10. Allport. J. A. M. A., April, 1903.
11. Tansley. Trans. Amer. Ophth. Soc., 1895, v. 3, p. 427.
12. Grimsdale. Text-book of Ophthalmic Operations.
13. Darier. Trans. Soc. d'Opht. de Paris, 1897, p. 110.
14. Fergus. Trans. Ophth. Soc. United Kingdom, 1908, p. 184. Brit. Med. Jour., March 30, 1901.
15. Roberts. Ophth. Rec., v. 25, p. 397.
16. Angelucci. Compt. rend. 13th Internatl. Congress de Méd. Paris, 1900, p. 329.
17. Sourdille. Clin. Opht., 1903, p. 73.
18. Motais. Trans. Soc. Franç. d'Opht., 1897, p. 208.
19. O'Connor. A. J. O., 1921, v. 4, p. 842.
20. Beard. Ophthalmic Operations, 249.
21. Aranquez, M. E. Ped. España, 1920, v. 9, p. 246.

22. Bruns. A. J. O., 1922, v. 5, p. 269.
23. Jackson, E. Ophth. Rec., v. 20, p. 70.
24. Jocqs. Clin. Opht., v. 25, p. 556.
25. Jackson, E. Ophth. Rev., 1903, v. 22, p. 61.
26. Hummelsheim. Trans. 34th Ophth. Congress, Heidelberg. p. 248.
27. Hummelsheim. Arch. f. Augenh., v. 62, p. 71.
28. Stuelp. Klin. M. f. Augenh., April, 1912, p. 469.
29. Woodruff. Trans. Sec. on Ophth. A. M. A., 1917, p. 267.
30. Turner. A. J. O., 1920, v. 3, p. 441.
31. Crossley. A. J. O., 1919, v. 2, p. 446.
32. Sweet. A. J. O., 1921, v. 4, p. 866.
33. O'Connor. A. J. O., 1919, v. 2, p. 197.
34. Dransart and Vanhoutte. Arch. d'Opht., v. 37, p. 371.
35. Peter. A. J. O., 1921, v. 4, p. 622.
36. O'Connor. A. J. O., 1921, v. 4, p. 838.
37. McDanald. Arch. of Ophth., v. 43, p. 515.
38. Posey. A. J. O., 1921, v. 4, p. 524.
39. Jackson, E. Amer. Encyclopedia of Ophth., v. 11, p. 8242.
40. Mayer. Surg. Gynec. and Obst., v. 22, pp. 182, 298, 472.
41. Mayer. Surg. Gynec. and Obst., v. 33, p. 528.
42. Biesalski and Mayer. Die physiologische Sehnenverpflanzung.
43. Dunn, N. Jour. Orthopedic Surg., v. 2, p. 554.

NOTES ON VISION AFTER CATARACT EXTRACTION.

DR. FELISA NICOLAS.

MANILA.

This is a frank report of the results obtained from cataract extraction in patients and under conditions quite different from those encountered in this country.

Cataract extraction, while not a very complicated operation, is one that is attended by so many dangers and complications during and after the operation, that it compels the prognosis for the vision to be reserved until the corneal wound is entirely healed up. The vision that a patient with cataract may have after its extraction may in a way serve as an index of the success of the operation. While it is true that the greater part of the success is dependent upon the technic and skill of the operator, the care of the patient before and after the operation and his behavior during and after the operation have very much to do with it.

This is a sort of report of our cases of cataract upon which extraction has been made. These cases were those admitted to the charity section of the Philippine General Hospital between July 1, 1921, and June 30, 1922, only. There were in all 36 patients; of these 20 were operated on in only one eye, and the rest in both. A total of 52 operations have therefore been made. In general these cases were almost normal except for the opacity of the lens. That is to say, there were no signs of conjunctival infection or of infection of the lacrimal sac, and no apparent lesion in any of the other structures of the eye, or its appendages.

In order to determine more carefully the presence of infection in the conjunctiva, we have been practising since last January the "cover test" suggested by Dr. Ubaldo, as practiced in Barraquer's clinic. This test consists in covering the eye to be operated on with a clean and dry eye pad (for a more delicate test a piece of oiled tissue paper is placed under the eye pad, for the latter may absorb the discharge if it is very small in amount), and this eye pad or oiled paper is examined at the end of 24 hours for the slightest trace of discharge. If this is positive, the operation is postponed.

In no instance was a case operated on where there was not a good perception and projection of light. This is only to show that in every one of these cases the retinal function was still retained. The duration of the loss of vision in all these cases varied from a few months to about 4 or 5 years. In two cases vision was still that of counting fingers at one foot distance in one eye, and two feet in the other. All these cases operated on were matured cataract, except three—one of these was immature and discission was made for maturation previous to ex-

traction; the other two were hypermature.

Simple extraction with capsulotomy has been the operation of choice. Lately, peripheral iridectomy has been added to the routine technic by one of the operators. All these cases included in this report have been operated on by only the two senior members of the staff. For convenience I have divided them into three main classes according to the amount of vision they had after the operation, taken at the time they were discharged, thus:

Class I. Those regarded as successful, who were able to read Snellen's test types at a distance of 20 feet, 22 cases or 43%. Of these, 4 had vision of 20/30 with the correcting glasses.

Class II. Those improved, included those that could count fingers at a distance of from 2 to 20 feet, 21 cases or 40%. Several of these cases could have had better vision had they consented to have discission performed since they were having secondary cataract. Others insisted on going home against the physician's advice, while the corneal wound was not yet healed.

Class III. Those unimproved, and regarded as failures, 9 cases or 17%. Of these, 3 went home while still having blood in the anterior chamber secondary to accidental iridectomy; 1 developed iridocyclitis with secondary cataract; 1 had slightly increased tension before operation, had accidental iridectomy during the operation, bleeding into the anterior chamber, and later on developed anterior synechia. There was no vitreous prolapse, however, in this latter case. Another failure case was that of juvenile cataract, where extraction has been made but developed secondary cataract, and this was responsible for the unimproved vision. One case had gaping of the corneal wound with prolapse of the iris and 2 cases of infection—one immediate, on 3rd day after the operation, and the other two months later, during which time repeated discissions have been made because of the secondary cataract present.

There were 8 cases with vitreous prolapse, only 2 of which fell under Class III, and therefore unimproved. There were 5 cases of prolapse of the iris, one of which was a failure. One case with incarceration of the iris in the corneal wound, and another with prolapse of both iris and vitreous, but strange enough, vision was 20/100 and 20/50 respectively. There were 15 cases of secondary cataract, and these were responsible for many of the slightly improved cases.

Conclusion.—It is therefore seen from the results obtained in these cases, that the operation for cataract extraction is followed in the great majority of instances by improved vision, and that the number of losses is very small in comparison with the former. Also complications and accidents like extrusion of vitreous (provided of course that this is not excessive) or prolapse of the iris during the operation should not be taken as necessarily meaning a bad result; since where these occurred, the patients had improved also and in some cases had even better vision than those where no such complications had happened.

CORRECTED REPORT OF COL. SMITH'S CATARACT OPERATIONS.

W. A. Fisher, M.D.

CHICAGO, ILL.

A later investigation of the results of the operations done by Col. Henry Smith in Chicago, with careful testing of vision after correction of the refraction, gives a more valuable and more favorable account of such results, than was possible shortly after the operations were done. Read before the Chicago Ophthalmological Society, October 16, 1922.

This report is made first for the betterment of Ophthalmology and its advancement, and secondly because I feel a personal interest in the final visual results after cataract operations by any method, which after all is said and done, is all important to the patient; finally in justice to Col. Smith, an invited guest of this Society.

On May 26th, 1921, Col. Smith performed the intracapsular cataract operation upon 16 eyes at the Chicago Eye,

Ear, Nose and Throat College in the forenoon, and in the afternoon of the same day, he operated in a similar manner upon 15 eyes at the Illinois Charitable Eye and Ear Infirmary.

All of the cases were reported December 12th, 1921, at the regular meeting of the Chicago Ophthalmological Society. Dr. Fisher reported the visual results of the 16 cases operated at the Chicago Eye, Ear, Nose and Throat College, and stated that the refraction had been made by the doctors who referred the cases and his report was from their findings. 11 of the cases, or 68.7%, received 20/30 or better.

Dr. Findlay reported on the 15 operated at the Illinois Charitable Eye and Ear Infirmary. His results gave 5, or 33.3% who had 20/30 vision or better.

One would not think it possible that Col. Smith with his collossal experience could operate in the morning and get 68.7% 20/30 or better, and in the afternoon of the same day, on a similar number of patients with the same method of operating, and get only 33.3% 20/30 or better.

The writer witnessed the 16 operations performed in the morning, directed their after treatment until they were discharged from the hospital, held the lids of the 15 operated in the afternoon, and could not understand how such a difference in the visual results could be obtained. He therefore wrote letters inviting to his office all of the cases that were operated at the Illinois Charitable Eye and Ear Infirmary, and reported as having less than 20/40. Four responded; three of them, Mr. O. S., Mrs. B. S., and Mr. J. M., (all reported as having 20/50) were each found to have 20/20.

To prevent any possibility of error, Drs. Faith, LaMothe, Tydings, and Wagner refracted each one of these patients separately in their private offices, and all were found to have 20/20 vision. The fourth case reported as having 20/50 has a good surgical result, fundus easily seen, but the patient has an old choroiditis. Mrs. J. R., residing out of town was reported as having 20/65, but a letter states that she has 20/20.

When the corrected report is made of the cases operated at the Illinois Charitable Eye and Ear Infirmary, and found to have 20/20, and reported as having only 20/50, the result will show 60% 20/30 or better instead of 33.3%.

Proper glasses must be adjusted after a cataract operation has been performed if the patient is expected to get use of what vision has been restored, and those who refract must have experience in adjusting glasses in order to get a good result.

I cannot say who refracted the cases operated at the Illinois Charitable Eye and Ear Infirmary, nor how much experience they had, but I believe you will agree with me that they should have had properly fitted glasses, especially when the operations had been performed by an invited guest of this Society.

Those who were reported as having 20/50 should have had an ophthalmoscopic examination before leaving the hospital, because if four of them reported as having 20/50 have 20/20 now, they surely had a good surgical result when they were discharged from the hospital. It would be well for Ophthalmology if ophthalmic surgeons would report the full findings as well as the vision obtained after operations for cataract. The surgical results are often much more interesting and instructive than the visual results, because one never expects 20/20 when the cornea is not clear, or in diseases of the fundus.

New methods should be carefully analyzed, especially when such an important procedure is concerned as an operation for cataract; but if new methods are condemned because they are new, how can we expect to progress? The intracapsular operation is not considered a new procedure because more operations with visual results have been reported by the intracapsular than by the capsulotomy method. The intracapsular operation may be considered difficult, and is difficult to perform; but a cataract operation by any method requires skill if good results are to be expected.

I could not refrain from making this report in all fairness to Col. Smith and the intracapsular operation as well as the capsulotomy operation, and I believe Ophthalmology will accept and be benefited by this correction.

Dr. Findlay stated in his report that the results of Col. Smith's intracapsular

operations were no better than the capsulotomy operation as performed at the Illinois Charitable Eye and Ear Infirmary, but the change from 33.3% 20/30 or better, to 60% 20/30 or better, makes a great difference in the report.

Active workers in the field of ophthalmology read reports of the results of new procedures, form opinions and often express themselves in print without any experience or knowledge except their reading, and for their good, great care should be exercised in reporting such results in order that progress may be made and that new procedures should not be condemned by those who are not in a position to give an opinion.

If the intracapsular cataract operation is to be condemned because it cannot be successfully performed by all operators, the capsulotomy operation can easily be condemned for the same reason.

ONE HUNDRED CONSECUTIVE CATARACT OPERATIONS.

E. A. KNORR, M.D.

BALTIMORE, MD.

This gives the statistics as to this series including the complications present during operation or arising subsequently; with the results obtained and details regarding a particularly difficult case in which good vision was obtained in spite of lack of cooperation on the part of the patient. See p. 133.

Sex and Race. White males, 45. White females, 34. Colored males, 14. Colored females, 7.

Age by decades. Third decade, 1. Fourth, 4. Fifth, 9. Sixth, 49. Seventh, 29. Eighth, 8. Oldest patient, 85 years. Youngest patient, 31 years. Age of the greatest number, 68 years, eight cases. Age of 66 and 67 years, seven cases each.

Type of operations. Combined extraction, 88. Smith operations, 9. Unintentional extraction in capsule, 1. Spontaneous expulsion of lens and vitreous, 2.

Right eye, 53, Left eye, 47. Details: Iridectomy performed with knife while making corneal section, 22. Capsule forceps used, 72. Cystitome, 17. Irrigation of anterior chamber, 84. Loss of vitreous, 13. Prolapse of iris, 1. Purulent infection, 1. Iridocyclitis, 3. Uneventful convalescence, 86. Detached retina, 3. Postoperative glaucoma, 6. Sunken cornea, 12. Striate keratitis, 6. Air in anterior chamber, 21. Blood in anterior chamber, 7. Cystoid cicatrix, 2. Restless patients, 17. Deafness, 4. Vomiting after operation, 5. Eczema of lids, due to sweating under shield, 4. Chronic conjunctivitis, 6. Mucocele, 1. Chloroform anesthesia, 2. Hypermature cataract, 3. Black Cataract, 2. Overlapped cornea, 2. Diabetes, incomplete record, 2. Lost eyes, 7.

The operations here reported were consecutive ones, performed on the usual run of patients, without selection, the majority of whom were dispensary patients. There are several points of interest in this report that require a more detailed description; among them are: Loss of vitreous, 13 cases, white, 4. Colored, 9. Smith operations, 4. Combined extractions, 7. Spontaneous expulsion of lens and vitreous, 2. Loss of vitreous before extraction of lens, 4; with lens, 5; after lens, 4; due to sudden squeeze of the eyelids during operation, 4. Due to blinking after operation, 2. Due to rupture of the zonule of Zinn while using capsule forceps, 2. Followed by detachment of the retina, 2. By iridocyclitis, 2. Vision finally attained: Counting fingers, 3. 20/200, 1. 20/60, 1. 20/50, 1. 20/30, 2. No record, 1. Loss of vision, 4. These statistics indicate that loss of vitreous is one of the most serious complications of the cataract operation; of the 13 cases of the series, only five or six came thru with useful vision.

Postoperative glaucoma, 6. All were combined extractions; among the contributing causes were: Prolapse of the iris, 1. Iridocyclitis, 1. Glaucoma at the time of operation, 1. No apparent cause, 3. White males, 3. White females, 2. Colored female, 1. Two of the patients were 82 years old; one 72 years old. Three of these glaucoma-

tous eyes were saved by paracentesis.

Lost eyes, 7. Purulent infection, 1. Iridocyclitis, 3. Detached retina, 3. White males, 2. White females, 3. Colored males, 2. Combined extraction, 5. Spontaneous expulsion of lens and vitreous, 2. The purulent infection occurred in a white man who was a very good patient, the operation was uneventful and the infection unexpected. The iridocyclitis cases occurred twice in one patient, a very feeble woman 82 years old; her lenses were black and very hard and not easily moved, the loop was used in each operation. The other case was in a weak white woman who became pale and fainty on the table; the cornea became overlapped by excessive blinking.

Of the six cases of chronic conjunctivitis and one of mucocele, good results were obtained in each case. All had been under treatment for long periods.

Vomiting after operation, 5. In two cases it occurred on the table after operation following chloroform anesthesia. In one case patient ate ice cream as soon as she returned to the ward. In one case patient suffered from slight shock. In one case vomiting began on the fourth day; recurred several times between the fourth and ninth day; no harm resulted in either case; the case of persistent vomiting had several small retinal hemorrhages but it could not be said that they were caused by vomiting. Chloroform anaesthesia, 2 cases, both in colored men on whom the Smith operation was performed; one lost vitreous; vision obtained in each case 20/200.

Vision, 10 days after operation, recorded in 51 cases as follows:—Less than 20/200, 7; 20/200, 18; 20/120, 12; 20/80, 6; 20/60, 5; 20/40, 2; 20/30, 1. Vision at last refraction, recorded in 71 cases as follows:—Less than 20/200, 2; 20/200, 5; 20/120, 5; 20/80, 9; 20/60, 13; 20/40, 12; 20/30, 13; 20/20, 12. The above figures show that 10 days after operation sixty per cent of the patients had a vision of 20/200 or 20/120, and that after several months had passed 70% had a vision better than 20/60. Seventeen per cent attained a vision of 20/20.

Vision, obtained in the Smith operations was recorded in six as follows:—Fingers, 1; 10/200, 1; 20/200, 2; 20/60, 1; 20/30, 1.

THE MOST NOTEWORTHY CASE.

Mrs. Eliz. G., Age 63 years. White; combined extraction, left eye, Oct. 20th, 1921.

This patient was very talkative, took a good deal of interest in her surroundings while on the table, moved her eyes about quite a little and blinked her eyes unnecessarily. She did not cooperate well during the operation, could not look downward while I was incising the cornea; the iris slipped over the knife and a piece of it was cut off, rendering further iridectomy unnecessary. The capsule forceps were then used, but before a piece of the anterior capsule tore off the lens became dislocated below. During expression, the lens tumbled, so that the lower edge came out first leaving a clear black pupil. Some soft lens substance and capsule stuck in and just below the corneal section, which was easily expelled, thus, rendering it unnecessary to irrigate the anterior chamber.

After the operation, patient continued to blink her eye a good deal; cotton and shield were applied and patient walked to ward. The following day she was resting quietly but complained of a sensation of a foreign body in her eye. I did not dress her eye until the following day. After removing the shield and cotton, I noticed vitreous oozing out between the eyelids. Upon opening the lids I found the upper part of the cornea overlapped, it seemed to be held between the margins of the eyelids. The overlapped portion was quite cloudy, while the lower half of the cornea was clear. The eye was cocainized and the overlapped portion replaced. The following day the lips of the corneal wound were in good apposition, the eye was not very red or painful and vitreous was no longer escaping; she could count fingers. Convalescence progressed favorably under the daily use of atropia and mercurochrome. The upper part of the cornea slowly became transparent, but no attempt was made to examine the upper

part of the corneal wound until Nov. 9th. 1921, 19 days after operation. A small bead of vitreous protruded thru the lips of the corneal wound, and a groove or kink extended horizontally across the cornea. Nov. 16th, 1921, corneal wound tightly closed. Nov. 30th, 1921, 40 days after operation, the horizontal ridge across the cornea completely effaced, the cornea clear thruout. The iris was caught in the corneal wound which drew the pupil up a little; a clear view could be obtained of the fundus; she complained of cyanopsia. Dec. 21st, 1921, two months after operation, vision with correction was 20/30. One year after operation vision was still 20/30.

FINAL RESULT OF CARCINOMA OF ORBIT PROBABLY ORIGINATING IN THE LACRIMAL GLAND.

C. NORMAN HOWARD, M.D.

WARSAW, INDIANA.

On December 15, 1914, I did an evisceration of the orbit on account of a carcinoma, which had apparently originated in the lacrimal gland.

In 1919, this was reported in detail and with some bibliography before the Indiana Academy of Ophthalmology and Oto-Laryngology. At that time—four years and five months—there was no indication of the return of the growth. This paper was printed in the May, 1920, issue of the American Journal of Ophthalmology (v. 3, p. 332). About that time the patient developed a cough and apparently was not doing well generally. It occurred to me that she might be beginning to have metastasis show from the original carcinoma in the orbit, altho there were no signs of any return there at that time.

I withheld sending out the reprints thinking that it would make a more complete scientific history to include the ultimate findings, if the surmise of the general carcinoma should prove correct.

The patient gradually became worse and died on July 16, 1922, having lived seven and one-half years after the evisceration of the orbit. A request for autopsy was granted. It was performed by Dr. H. F. Steele, the home physician, Dr. C. C. DuBois and myself. We found that, within the last year or so, the orbit had filled up, but that there was no extension out on to the face. The skull was not opened as she had had no brain symptoms.

There was, however, a widespread malignancy thruout the chest and abdomen. The lungs and pleurae were almost solid with new growths. The liver was enlarged to four finger breadths below the costal arch, and was studded with hard bodies. There did not seem to be any masses in the stomach, but there were some in the omentum.

Perhaps the most striking feature of the examination was the spleen. This had grown enormously, and was studded with masses similar to those mentioned above. The spleen weighed 4 pounds, was 8 1/2 inches long, 6 1/2 inches wide and 4 inches thick.

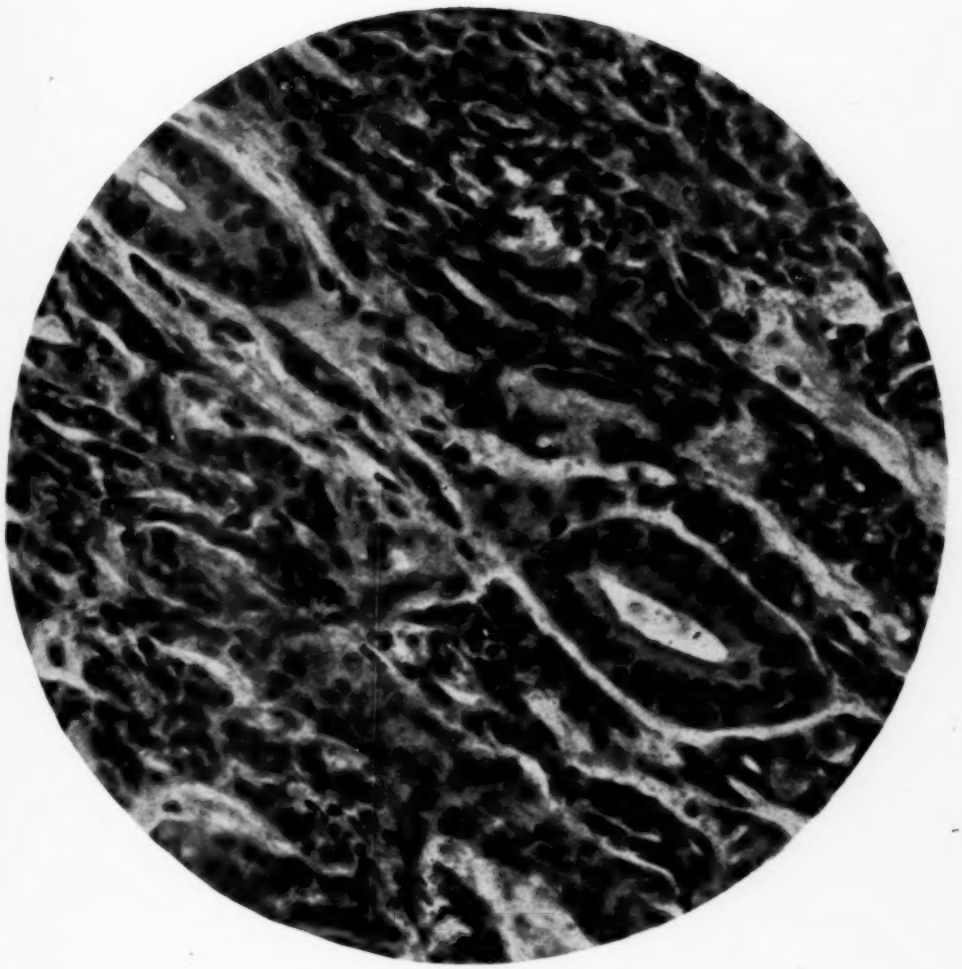
As Dr. W. D. Gatch of Indianapolis had made the examinations for me in 1914, I sent the specimens to him from this autopsy, that is, from the left orbit (the diseased one), lungs, liver, spleen and glands.

I received the following report from Dr. Gatch:

"I have been very much interested in the specimens sent to me and have worked on them at odd moments for several weeks. First, sections were compared from the original tumor removed and normal lacrimal gland, and the original diagnosis of cancer verified. I then studied sections from the pieces of tissue recently sent; the latter present a similar picture thruout, namely, masses of cuboidal shaped cells with more or less circular and oblong nuclei without mitotic figures and with great variation in staining properties.

"In places, these cells are arranged in solid masses, which show circular, oblong and fissure like spaces, surrounded by a single layer of cells. In other places, especially from the orbital growth, there is a frank adenomatous structure.

TISSUE FROM PRIMARY GROWTH REMOVED IN 1914. MAGNIFICATION 50 DIAMETERS. NOTE LOBULES OF NORMAL GLAND, AND CARCINOMATOUS TISSUE. (PHOTOMICROGRAPH BY DR. W. D. GATCH.)



HIGH POWER VIEW OF SAME SECTION AS FIG. 1, SHOWING SMALL AREA OF CARCINOMATOUS TISSUE. MAGNIFICATION 400 DIAMETERS. (PHOTOMICROGRAPH BY DR. W. D. GATCH.)

"W
many
nata,
are
gland.
endoth
count
minut
graphs
ing pu
these
"Th
rather
lieve
tremel

P.
During
the in
Hawai
drew a
shots a
he plac
face a
brough
scious

Fig. 1

"Writers apparently have described many tumors of this type as endotheliomata, but Ewing states that most of these are probably cancer of the lacrimal gland. It is easy to see how the idea of endothelioma might be obtained. On account of its rarity, I intend to have minute descriptions and photomicrographs of the tumor prepared for teaching purposes. I can send you some of these if you so desire.

"The distribution of metastasis is rather remarkable for cancer, but I believe can be accounted for by the extremely long time the patient survived the primary operation. If on further study any new conclusion is reached, I will let you know at once."

The accompanying photographs were later supplied and labeled by Dr. E. V. Heahn, of Indianapolis, coworker with Dr. Gotch.

According to an article by Dr. Lane in the American Journal of Ophthalmology for June, 1922, (v. 5, p. 425), it would seem that in the literature there have been reported only nine other cases of metastasis following tumor of the lacrimal gland. Seven of these were verified at autopsy and two were not.

GUNSHOT WOUND OF ORBIT, OPERATION, RECOVERY.

JAMES A. MORGAN, M.D.

HONOLULU, T. H.

P. Cho., Korean, age 21, chauffeur. During a family row, and while under the influence of okolehao (a native Hawaiian intoxicating drink), the patient drew a 32 calibre revolver and fired three shots at his wife, whom he missed. Then he placed the gun to the right side of his face and fired one shot. Patient was brought into the hospital in an unconscious condition. There was a small perforating wound on right side of the face just below the malar bone; which was blackened with powder, and bleeding profusely. The right eye was swollen shut.

Palliative measures were carried out for twenty-four hours, until the patient had regained consciousness, when an examination was made. Eyelids were swollen and edematous. Vision was re-

Fig. 1.—Gunshot wound of orbit (Morgan's case). Front view showing foreign bodies in right orbit.

duced to counting fingers at close range. Ophthalmologic examination at this time revealed overfilled veins and a hazy nervehead. X-ray showed a bullet in the posterior orbit; and the lateral view

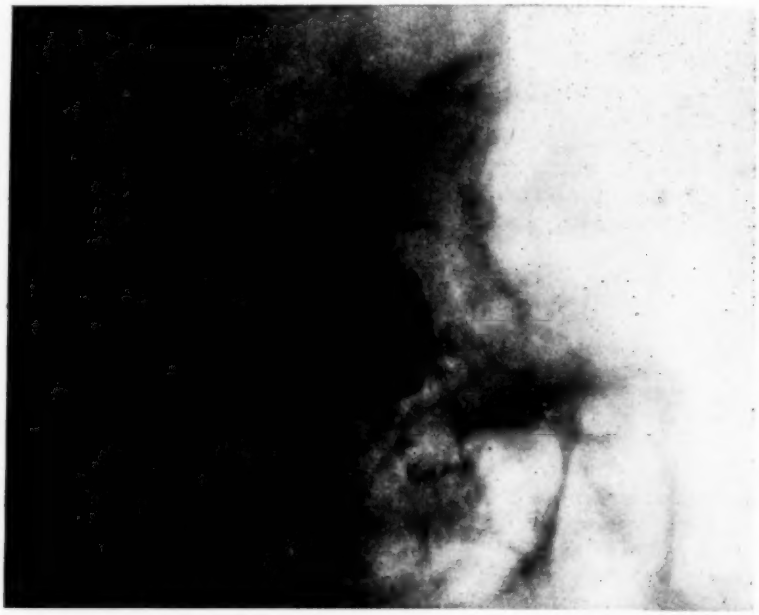


Fig. 2.—Side view of Morgan's case showing depth of foreign bodies in the orbit.

a number of fragments along the track of the bullet.

Krönlein's technic was used, but upon uncovering the bone of the right external orbital it was found so fragmented that it had to be removed in pieces. The pathway of the bullet was followed, and it was found lying on the optic nerve about one inch posterior to the globe. Apparently there had been no injury to the nerve, as the ultimate recovery without loss of vision shows. The patient made an uneventful recovery and when last seen, two weeks after the operation, there were no apparent eyeground changes, and the vision had improved to 20/40.

SOCIETY PROCEEDINGS

Reports for this department should be sent at the earliest date practicable to Dr. Harry S. Gradle, 22 E. Washington St., Chicago, Illinois. These reports should present briefly the important scientific papers and discussions.

BALTIMORE MEDICAL SOCIETY.

Ophthalmological Section.

October, 1922.

Etiology of Herpetic Keratitis.

Dr. Jonas S. Friedenwald read a paper on the etiology of febrile herpes and allied forms of herpetic keratitis, reporting the results of investigations made under direction of Dr. F. H. Verhoeff at the Laboratory of the Massachusetts Charitable Eye and Ear Infirmary and the Department of Pathology of the Harvard Medical School.

Clinically herpes is classified as herpes zoster and febrile herpes, the latter term including facial, corneal and genital forms. Febrile herpes has generally been thought to be merely a symptom. Recent studies, however, would lead to the conclusion that it is due to a specific infection. Grueter was able to produce in a rabbit a herpes like keratitis by inoculation from a case of herpetic keratitis. Löwenstein, Luger and Lauda produced similar results by inoculation from facial and genital herpes. The disease can be carried from rabbit to rabbit indefinitely. He has confirmed these experiments by successfully inoculating rabbits from every one of twelve cases of herpes, two of corneal herpes and ten of facial herpes. Control inoculation from a great variety of sources failed to produce the typical result.

Twenty-four hours after inoculation, one can see minute vesicles along the scratch made by the inoculating knife. In 3 to 4 days the condition reaches its height, with violent conjunctival congestion, purulent secretion, and both punctate and dendritic corneal lesion. Subsequently the inflammation subsides, leaving more or less corneal opacity. A certain number of the animals develop, during the second or third week after inoculation, symptoms of a profound general infection, marked nervous irritability, salivation, trismus, paralyses, and convulsions.

Doerr has demonstrated that this disease is an encephalitis, which can be transmitted from one rabbit to another by intracranial inoculation, and that it is due to the same virus which causes the keratitis. He showed that the virus of herpes was practically identical with the supposed virus of encephalitis lethargica.

The pathology of corneal lesions in infected rabbits resembles that of herpetic keratitis in man. The socalled "herpes bodies" of Lipschuetz can be easily seen in early stages. They represent, I believe, a special form of cellular degeneration. Beneath Bowman's membrane there is a polymorphonuclear infiltrate. In severe cases the cornea is widely ulcerated and necrotic. No lesions were found in the interior of the eye except a descemetitis and iritis. The lesions in the brain resemble those of encephalitis lethargica in man, but lesions of this kind are often found in supposedly normal rabbits. Lesions were found in the posterior ciliary nerves and gasserian ganglion. This is probably the path of the virus from the cornea to the brain. Friedenwald was able to infect a rabbit with an emulsion of the gasserian ganglion of another rabbit, whose cornea had been previously infested. Levaditi believed that the path of the virus from the cornea to the brain was thru the interior of the eye and up the optic nerve. However no lesions can be found here.

The local therapeutic agents commonly used in treating herpetic keratitis have no favorable effect on the disease in rabbits. Mercurochrome, argyrol, holocain, and tinctur of iodin were all tried, and gave negative results. Cocain does harm.

Discussion.—Dr. H. L. Amos: I have been unable to confirm the work of Loewe, Strauss, and Levaditi on encephalitis. Normal stock rabbits often show the brain lesion supposed to be typical of encephalitis infection. This probably is due to the existence of an enzootic disease among rabbits. Her-

pes virus, however, gives 100% takes, and when inoculated subdurally kills with great regularity. I have been interested in the salivation of these infected animals, which is so profuse that the fur of their chests becomes soaked with saliva. It would be interesting to know whether the parotid gland shows pathologic changes. The virus of herpes does not seem to be filtrable in the same sense as the virus of poliomyelitis. Out of 15 attempts, I have succeeded in passing it thru a Berkfeld filter only once.

The minuteness of the amount needed to cause the disease in rabbits is extraordinary, and recalls the virus of poliomyelitis, which, when introduced into the brain or the eye of a monkey in most minute quantities, is able to cause the disease. When this virus is inoculated into the eye of a monkey it leaves no pathologic lesions, tho it produces lesions in the brain, Polio. virus is not virulent for rabbits, whereas herpes virus is not virulent for monkeys.

Dr. Chas. Simon: Lipschuetz has described the socalled "herpes bodies" both in human lesions and infected rabbits' corneas. They are intranuclear accumulations of stainable material, which he believes are a reaction on the part of the cells to the presence of the virus. They are analogous to the cell inclusions found in molluscum contagiosum, rabies, trachoma etc. It is most astonishing to find that a labial herpes, occurring after a gastrointestinal upset, or menstruation, or as some think after a psychic shock, contains a virus that will induce such a violent disease in rabbits. I saw Doerr inoculate rabbits both corneally and subdurally, with resulting death from encephalitis. Doerr has found the virus of herpes to be similar to the virus of encephalitis; even to the point that an animal which has been rendered immune to herpes virus is immune also to encephalitis virus. The relation of epidemic of encephalitis to influenza, together with the discovery of the virus of influenza as probably also a filtrable virus, is interesting.

Dr. Friedenwald: The salivation of these animals is, as Dr. Amos has said, most striking, and the virus can sometimes be recovered from their saliva. The relations of encephalitis to influenza and of herpes to common colds raise the possibility that these may all be related diseases. However, I was unable to produce a keratitis in rabbits by inoculation with the nasal and buccal secretions of persons suffering from common colds. Whether in this herpes virus we are dealing only with a rabbit virus, which has somehow been activated by whatever there is in the herpes, is an important question, in view of the lesion found in the brains of previously normal rabbits.

I have attempted to discover this rabbit virus. Rabbits' corneas were injured by various means and subsequently inoculated with a mixture of the nasal and buccal secretions of two other rabbits. I was never able to produce a typical keratitis in this way, tho some of these animals when tested were later found to be susceptible to infection from human herpes. Furthermore, certain workers have been able to infect with herpes virus, not only rabbits, but also white rats and guinea pigs.

It is interesting to speculate on the portal of entry of this virus in human cases. Clinical evidence would seem to show that the virus enters by way of the upper respiratory tract, and that it reaches the skin by way of the sensory nerves. It is interesting to note that in many persons the infraorbital branch of the trigeminal nerve courses along the roof of the maxillary sinus, where it is covered only by mucous membrane. It is in the domain of this nerve that herpes is most common.

Reaction of Pigment Cells to Foreign Bodies.

Dr. D. T. Smith reported upon his work (in the Department of Pediatrics of Johns Hopkins Hospital) with tissue cultures, using the cells obtained from the chick. He found that the retinal pigment layer consisted of a single layer of pyramidal cells, containing small rod shaped pigment granules. In the region of the ora serrata, these granules were round. These pigment granules were the product of the cyto-

plasm, as in very young cells they were seen as granules without pigmentation, while later the pigment developed. The choroidal cells were long, branched, connective tissue cells with round pigment granules, much smaller in size. All intraocular tumors that he had been able to study contained this form of pigment cell, with one exception, and that seemed to be epithelial in character originating from the ora serrata.

The reaction of these cells to foreign bodies or bacteria was very similar. If a cell died, the pigment granules were discharged and then became attached to another cell, finally passing thru the cell membrane and moving about in the cytoplasm by a jerky movement, soon becoming agglutinated and being surrounded by a vacuole and ultimately breaking up. The same process took place when avian tubercle bacilli were introduced; in case too many organisms entered a cell, there was death to the cell, with proliferation of the bacteria and liberation of pigment granules.

He considered it probable that five types of pigmented cells occurred in eye:

First:—Pigment cells of the retina with rod shaped granules.

Second:—Pigment cells from the ora serrata with round pigment granules.

Third:—Long branched choroidal cells with small round granules.

Fourth:—Cells with ingested pigment granules from either one, two or three.

Fifth:—Cells with ingested blood pigment.

Discussion.—Dr. Allan Woods: I think Dr. Smith's work tends to prove that this pigment substance acts as a foreign proteid. In my work upon anaphylaxis, I have not been able to separate the retinal from the choroidal pigment cells.

Dr. C. A. Clapp: This study of Dr. Smith's is also interesting in view of Mr. Collins' explanation of retinitis pigmentosa, in which he claims that there is a primary atrophy of the neuroepithelium of the retina, with subsequent atrophy of the inner layers, and a wandering of the retinal pigment cells thru openings in the internal limiting membrane, with the ingesting of the cells by the connective tissue around the blood vessels. It will be exceedingly instructive to study sections to determine the source of the pigment granules.

Dr. Smith: Dr. John Abel at Hopkins has made a considerable study as to the chemistry of this pigment, but so far has been unable to give it a formula.

Cataract Extractions.

Dr. E. A. Knorr reported 100 cataract consecutive extractions. See page 126.

Discussion.—Dr. Hiram Woods in discussion spoke of the very great utility, when operating upon colored patients, in requesting that they keep their mouth open, as he has found it very much more difficult to squeeze under those conditions. He believed that if one eye had useful vision, the other eye should not be operated upon. In case of immature cataract in both eyes, where the vision was much impaired, the extraction should be performed, preferably with a preliminary iridectomy, and the use of Knapp's capsule forceps. He believes that irrigation is not usually beneficial and has abandoned it. He reported one case of pneumooccoccus infection of the eye some weeks following pneumonia, and recently he has had a case of propulsive hemorrhage.

C. A. Clapp,
Secretary.

COLORADO OPHTHALMOLOGICAL SOCIETY.

October 21, 1922.

Dr. E. R. Neeper presiding.

Abuses of Blind Pension Law.

Edward Jackson called attention to serious abuses in the administration of the state law for pensions to the blind. In the course of discussion, a number of members of the society related cases in which pensions had been awarded in spite of expert opinion that the reduction of vision of applicants did not amount to blindness; the amount of vision possessed by some successful applicants for pensions having been as

great as twenty-five percent of normal. The society adopted resolutions in favor of calling the attention of the proper executive officers of the state to the necessity for more careful administration of the law.

Optic Atrophy Following Injury.

C. H. EVANS, Colorado Springs, presented a woman, aged forty-three years, who five years previously had been severely injured by a fall from a merry-go-round. Soon after the injury she had noticed that the hearing of the left ear was greatly reduced. A scar in the ear drum suggested that the drum might have been ruptured. Two years after the accident, the patient had noticed that she had scarcely any vision in the left eye. At the time of report the vision of this eye was light perception. The optic disc was atrophied.

Dense Interstitial Opacity of Cornea.

C. H. EVANS, Colorado Springs, presented a woman, aged seventy-eight years, who had previously suffered from a protracted ulcerative keratitis without rupture. The corneal substance of the right eye was now almost completely infiltrated with a dense yellowish opacity. There had been very little or no pain. The teeth had been X-rayed and cared for, and antirheumatics had been used steadily.

Discussion.—J. M. SHIELDS, Denver, would enucleate the eye.

MELVILLE BLACK and EDWARD JACKSON, Denver, would leave the eye alone as long as there was no special reason to interfere.

Hemorrhagic Neuroretinitis.

E. M. MARBOURG, Colorado Springs, presented a woman, aged fifty two years, who had come complaining of dimness of vision in the right eye. Ophthalmoscopic examination of the affected eye showed marked neuroretinitis, with flame shaped hemorrhages radiating from the disc, and also occurring in the lower half of the retina. In the macular region was a white area of exudate, and there was also present in this region a number of punctate hemorrhages. The veins were irregular and tortuous. Wassermann test and urinalysis were negative. The blood pressure was 145 mm. Under venesection and iodids the vision rose in a week to 20/40; but with recurrent hemorrhages, the vision receded to 20/200, at which point it had remained after eight months. The left eye had remained normal as to vision and ophthalmoscopic appearance.

Undeveloped Fovea.

A. C. MAGRUDER, Colorado Springs, presented a boy, aged nine years, whose vision was limited to 8/200 in each eye. Retinoscopy showed a required correction of + 1.25 sphere, but the improvement with this lens was only to 20/200, right or left. A diagnosis of undeveloped fovea having been suggested, the high frequency current had been used daily for over a month, but so far without improvement. The fovea could not be detected by ophthalmoscopic examination.

Discussion.—W. H. CRISP, Denver, referred to microscopic examination which had been made in a few albino eyes, and which had indicated a lack of differentiation of the retina at the normal position of the fovea centralis.

Episcleritis.

A. C. MAGRUDER, Denver, again presented a woman, aged fifty three years, who had been brought before the society one year previously on account of an episcleritis of three years standing in the left eye. The disturbance in the left eye had been cured by parenteric injections of milk. The patient was now shown on account of the end results of an old episcleritis as manifested by four crescent shaped opacities of the cornea, in each instance located a short distance from and parallel with the corneal margin, and measuring about one by four mm. These opacities roughly corresponded to the locations of the four recti muscles. The patient was at present suffering from an attack of episcleritis in the other eye. On this occasion injections of milk had been without appreciable results, and had been discontinued on account of the pain following the injection. She was showing slight improvement under a prescription recommended by Dr. Sedwick a year ago, consisting of a mixture of aloes and iron. During his recent visit to Colorado, Prof. Fuchs had referred to the corneal opacities in the right eye as typical "end results" of the episcleritis.

Nuclear Cataract plus Aniridia.

A. C. MAGRUDER, Colorado Springs, presented a woman, aged fifty-six years, whose left eye had a nuclear cataract, and in which the relation of the cataract to the entire lens was strikingly displayed by absence of the iris. Vision of this eye was light perception; that of the right eye 3/200, due to very high myopic astigmatism. Operative interference with the cataract was not contemplated.

Discussion.—MELVILLE BLACK, Denver, agreed that it would be well to leave the cataractous eye alone as long as possible.

Glaucoma. Luedde's Operation.

J. A. PATTERSON, Colorado Springs, presented a man, aged sixty-seven years, who gave a history of having had only light perception with the right eye since a blow on the eye at the age of seven years. For about three months the vision of the left eye had been failing. There had been no pain, but the pupil was dilated and irregular, and the tension of this eye was 42 to 48 mm. The tension of the right eye was 42 to 43 mm. There was distinct atrophy of the left iris downward and outward. Repeated instillations of eserin had failed to produce more than a trifling contraction of the left pupil, but the tension had been moderately reduced. Between the right iris and the upper part of the lens was a bluish-white structure of uncertain character. (Dr. Patterson later reported that he had done Luedde's operation on the right eye.) The uncertain structure behind the upper part of the iris proved to be lens capsule. The increased tension of the eye caused the iris to protrude slightly from the small keratome puncture, but the iridectomy was accomplished without accident. Dr. Patterson felt that the eye would have been lost by any other procedure.

Discussion.—EDWARD JACKSON and MELVILLE BLACK, Denver, both felt that it would be desirable to limit treatment of the left eye to miotics as long as the vision did not grow worse.

Sympathetic Ophthalmia. (?)

E. R. NEEPER, Colorado Springs, presented a youth, aged eighteen years, whose right eye had been laid open by a flying nail at five years of age. The vision of this eye had since been limited to light perception. At thirteen years of age, a kick from a horse had fractured the anterior wall of the left frontal sinus. Apart from swelling of the eyelids, the left eye had seemed to suffer no disturbance from the kick. Six months later, without pain or inflammation, the left eye had rather abruptly become blind. After one year of comparative blindness, the vision had gradually improved until now L. V. was 10/200. Only questionable improvement was obtained from a lens. The vitreous contained many opacities. Was the loss of vision of the left eye due to the kick of the horse, or to sympathetic ophthalmia excited by the old injury of the right eye? A report by Dr. Mullin on the condition of the nose and accessory sinuses indicated that neither the injury nor the intranasal condition had probably had anything to do with the loss of vision of the left eye.

Discussion.—MELVILLE BLACK, Denver, was in favor of removing both the right eye and the tonsils as possible sources of disturbance.

W. F. MATSON, Denver, said that in a case he had seen, cataract had developed a year and a half after an injury.

EDWARD JACKSON, Denver. Would not an intraocular hemorrhage explain the changes which have occurred, including the primary visual disturbance of the left eye, the gradual clearing of vision, and the opacities in the vitreous? Some time ago, Dr. Finnoff showed several cases in which hemorrhage occurred long after injury or inflammation.

Coloboma of Iris.

E. R. NEEPER, Colorado Springs, presented a boy, aged twenty-five months, in whose left eye there was a congenital coloboma of the lower iris extending downward to the limbus. The upper edge of the pupil was much below the normal position. Was any benefit to be expected from an optical iridectomy?

Discussion.—Opinions against any interference with the eye were expressed by several members.

Cataract at Twenty-four Years.

E. R. NEEPER, Colorado Springs, presented a woman, aged twenty-four years, the vision of whose right eye had been

failing for two and a half years. The vision had got rapidly worse during 1922, and was now light perception. Projection was normal. During the past year the left eye had been failing, and for the past six weeks the patient had been unable to read. Left vision was now 20/200. Cataract was complete in the right, partial in the left. In the anterior portion of the right lens opacity, there were grooves of apparent absorption having the usual sector arrangement. Urinalysis was negative. Blood examination revealed simply a moderately pronounced secondary anemia. Should the right lens be needled, or extracted without iridectomy?

Discussion.—EDWARD JACKSON, Denver, suggested that the star shaped lines in the right cataract might be due to a bursting or splitting of the nucleus. A linear extraction with the lance knife would probably be best, without iridectomy if the pupil dilated well. There was an objection to many needlings in a patient who was distinctly below normal health.

MELVILLE BLACK, Denver, would first needle widely and then do a linear extraction, washing out the soft lens substance.

C. E. WALKER, Denver, would needle, and would only later go in with the lance keratome if increased tension made it necessary to operate promptly.

DR. JACKSON would prefer a slight needling at first, if needling were decided upon, suiting the subsequent action to the progress of the case.

Whether to Operate on Incomplete Cataract.

E. R. NEEPER, Colorado Springs, presented a woman, aged sixty-eight years, who for six months had been unable to use her eyes for reading. Both crystalline lenses presented anterior capsular striations of an unusual character, and also a haziness of the posterior capsule in the horizontal plane. The periphery of each lens was for the most part clear. The vision was right 10/80, left 10/60, unimproved by glasses. Should the cataract be hastened or operated upon?

Discussion.—EDWARD JACKSON, Denver. If the cataractous condition renders the patient practically helpless it would be all right to operate. I would make a linear opening in the upper part of the capsule.

W. H. CRISP, Denver. I would do a regular cataract operation. It might be necessary to do a secondary needling, but there would not likely be much trouble from cortex.

MELVILLE BLACK, Denver. Do your iridectomy, make pressure on the lens below as tho for intracapsular extraction, and then if necessary incise the capsule with Fisher's needle while the upper edge of the lens projects thru the iridectomy opening.

WM. H. CRISP, Secretary.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

October 10, 1922.

DR. J. B. STANFORD reported the case of: Mrs. J. A. A. 20, who was injured in an automobile accident on the morning of April 22nd, this year. Besides other wounds, there were wounds of the right upper eyelid and right eye. The eye wound was horizontal, beginning in the sclera about 2 1/2 or 3 mm. to the temporal side of the cornea, and extending across the cornea about 2½ or 3 mm. into the sclera of the nasal side. The wound included all layers of the cornea, and the iris was prolapsed at the temporal side.

Under local anesthesia, a flap of conjunctivia was prepared above the cornea, then the prolapsed iris was excised and the flap was brought down, covering the entire corneal and the scleral wound. This operation was done more or less under protest, and a very bad prognosis was given. Three sutures were used to hold the flap, and the center one was the last to pull out. This occurred the night of April 30th.

At the next dressing on May 1st, the wound was seen to be closed, the cornea clear except for scars, and some iris was in the wound at the nasal side of the cornea. This prolapse probably occurred while the conjunctival flap was being drawn over the cornea. The eye was not entirely clear of injection until the first week in July.

Her vision and refraction were examined at various times until September 10th, when the vision in the injured eye was found to be 20/100, corrected to 20/20 by —1.50 S.+ 4.75 C., axis 125°.

Discussed by Drs. Blue, Lewis and Savage.

D. H. ANTHONY, Secretary.

SOCIÉTÉ d'OPHTALMOLOGIE PARIS.

June 17, 1922.

Polack presiding.

Radiography of Orbit.

E. HARTMAN. For radiography for the front of the cranium, the head is usually placed with the brows and nose against the plate. This shows both orbits and adjoining parts. But this obscures the lower part of the orbit by the shadow of the base of the skull. A better view is obtained by bending the head to one side so that the normal of the rays makes an angle of 32° with line joining the root of the nose and the occipital protuberance. The sphenoidal fissure then becomes visible in its outer two-thirds. To see the entire fissure, the head should be inclined less laterally, so that the ray passes more in the axis of the orbit, making an angle of 10 degrees with the sagittal plane. The lower wall of the orbit and the sphenomaxillary fissure particularly require marked flexion of the head, so that the normal of the rays makes an angle of 21 degrees with the nasion-inion line. To obtain a good view of the optic canal, the normal or axis of the rays must pass in the direction of the canal. This is secured by placing the tube 7 cm. behind the occipital protuberance, 6.5 cm. to the opposite side of the median plane.

Intermittent Diplopia after Abortive Epidemic Encephalitis.

J. DARRIEUX reported the case of a boy of 16, who came with diplopia from paralysis of the left external rectus. One week later, he had slight ptosis of the right eye, but had regained some movement of the left eye outward. He was quite somnolent but responded well to questions. After this the paralysis of the left eye improved, the ptosis of the right grew worse, and vertical movements of both eyes became limited. In four weeks the movements of the globe were well executed in all directions, except slight limitation upwards for right and outward for the left; and there was a slight deficiency of convergence. The somnolence had disappeared six weeks after the attack.

At the end of five months there was again ptosis on the right side and imperfect convergence; the ptosis disappeared in a week. At the end of seven months diplopia recurred without ptosis. It disappeared in ten or twelve days, but recurred again at the end of ten months, the false image being above and crossed. It passed away in 2 weeks.

Eighteen months after the attack, there occurred homonymous diplopia, increased on looking to the right; and this was occasionally noticed for three months, when slight right ptosis appeared. This persistence of variable diplopia was the special peculiarity of the case; which ended in spontaneous cure.

Chorioretinal Tuberculosis.

J. CHAILLOUS reported on a boy of 16, who had first been seen 5 years before for high mixed astigmatism, corrected vision being 0.3 and 0.9. He now complained of poor vision in the right eye, and showed a lesion near the posterior pole which had reduced his vision to 0.1, with an absolute central scotoma. The lesion was yellowish in color, not elevated. Five days later there was swelling, which also involved the optic disc. A month afterwards there were retinal spots resembling albuminuric retinitis. The disc was more covered by swelling. Vision remained the same. The field of vision showed a sector defect. The vitreous was clear except some very fine threads of opacity. The patient gave a strongly positive tuberculin reaction, and had suffered from pleurisy and other lesions of tuberculosis.

Dr. Chaillous also reported a case of a boy who at two years had strabismus, the left eye deviating. He was nervous, poorly nourished, subject to

bronchitis and had enlarged cervical glands. Vision of the right eye was 0.9, left 0.4. The lower part of the fundus gave a brilliant white reflex, the posterior pole being normal. The tuberculin reaction was feebly positive. The condition of the eye had not materially changed in 2 years. It appeared to be one of chorioretinal degeneration with partial *detachment of the retina* of obscure origin.

Discussion. — ROCHON-DUVIGNEAUD thought these patients presented the difficult question, as to whether lesions were or were not tuberculous. Within the eyeball the test by inoculation could not be applied.

MAGITOT suggested that it was possible in such cases to examine the aqueous humor, using a chemical and microscopic methods. The anterior chamber was easily punctured by a needle 0.5 mm. in diameter, and he had never seen it cause complications.

POLACK suggested examination with a large binocular ophthalmoscope might give valuable information.

MEETING OF MAY 4, 1922.

Gonococcus Conjunctivitis Treated by Serum of Sterian.

ROCHON-DUVINGNEAUD and VALIERE-VIALEIX. A man of 19 had suffered three weeks from gonococcus urethritis, when he presented in his right eye edema and infiltration of the lower lid and conjunctiva, and redness of the bulbar conjunctiva without chemosis. Secretion was still rather slight and showed few gonococci. Silver nitrat treatment was used; but in 2 days the swelling had increased, chemosis was marked, but the cornea, remained clear. 2 cc. of the serum of Sterian was injected under the clavicle, and 2 hours later 17 cc. in the upper lateral portion of the thigh. Irrigation with weak permanganat solution was used locally. Next day the symptoms were worse; but the injections were continued every second day until 5 had been given, when the swelling of the lids had disappeared, chemosis was diminished and the secretion was diminished and again appeared serous. The improvement continued, and within 3 weeks of the time he was first seen, the eye was cured without ulceration of the cornea.

Discussion.—JOCQS had not tried the serum of Sterian, but in a case of similar conjunctivitis, in a boy of 16, which had lasted 15 days and presented ulcer of the cornea, he made three injections of 5 cc. of sterilized milk.

DUVERGER had treated cases with the serum of Sterian: One of an adult of 23 who had suffered 48 hours, and was completely cured in 8 days. Another aged 28 had suffered 5 days from urethral discharge, but was treated the first day of conjunctival involvement, and in ten days was completely cured. Of ten new born infants, 4 were completely cured in 6 to 12 days, 4 others improved rapidly, then relapsed, but were finally cured without ulceration of the cornea except in one case, which, however, did not perforate. He believed the serum had a real value in gonococcus conjunctivitis.

The Washington Congress.

PROF. DE LAPERSONNE reported his favorable experiences and impressions of the recent Ophthalmological Congress at Washington, and stated that Dr. de Schweinitz had been invited to address the meeting at Strassburg in May.

MAGITOT also referred to his own experiences among his American confrères. He mentioned the custom of the American Academy of Ophthalmology and Oto-Laryngology of inviting each year a distinguished guest to address it as one that might be wisely followed by the Société Française.

THE ROYAL SOCIETY OF MEDICINE, LONDON.

Section on Ophthalmology.

Meeting of November 10th. President, Mr. A. L. Whitehead, of Leeds.

Dislocated Calcareous Lenses.

MR. HUMPHRY NEAME exhibited and demonstrated two specimens of calcareous lenses, which had become dislocated into the anterior chamber. Each of the patients gave a history of trauma, when probably the dislocation took place, and the calcareous deposits occurred later. The calcium content was demonstrated under the microscope.

Retinitis Circinata.

MR. NEAME also showed, in a man, aged 39, a case of retinitis circinata, which condition had been seen to gradually develop. First there was a hemorrhage, of about two discs diameter; three months later there was a swelling above this hemorrhage, and later still there was a grey-white coating on it. As it had remained constant three months, he did not regard it as a neoplasm. On the idea that it might be inflammatory, possibly tubercular, injections of Tuberculin B.E., were given, but no local exacerbation or temperature reaction took place. Wassermann was negative, and there was neither sign nor history of syphilis. Other possibilities were a cyst of the retina, or exudative retinitis. His own feeling inclined to cyst of the retina, or exudative retinitis with a deposit, mainly fibrous, in the seat of a previous hemorrhage. He exhibited slides of a section from a case of the late Mr. Coats, in 1911, who had the eye excised in 1921 by Mr. Greeves on account of a painful glaucomatous condition. The case seemed to show a connection between hemorrhagic retinitis circinata and exudative retinitis.

Discussion. MR. MALCOLM HEPBURN said many cases of socalled retinitis circinata originated in the choroid; the original inflammatory deposit occurred there, and the deposits were always more intense at the macula.

SIR WILLIAM LISTER referred to the case of a man who received a blow on the eye, and later developed a large subretinal hemorrhage in the region of the macula. It produced a plum-colored spot. Gradually the hemorrhage absorbed, and disclosed a large choroidal rupture. There was seen a configuration of white areas, such as occurred in retinitis circinata, but as a mere temporary condition following the rupture. He believed that in retinitis circinata there was a low form of infection, which caused the change to become more permanent.

MR. LESLIE PATON reminded members that the case of the condition shown recently by Mr. Williamson-Noble had a positive complement fixation test to tubercle, and that Dr. Axenfeld strongly believed that many of the cases of vitreous hemorrhage in young people were tubercular in origin. The lesion in this present case might be tubercular, not a cyst. This view was supported by the PRESIDENT, who strongly suspected the tuberculous origin of spontaneous hemorrhages.

MR. NEAME, in reply, said he thought there might be a number of causes of retinitis circinata, which he regarded as a physical sign.

Congenital Dislocation of Lens.

MR. MONTAGUE HINE showed a boy, aged 6, with congenital dislocation of lenses, and asked advice as to what was best to be done. Some had advocated leaving such a case alone until later in life, meantime watching it and noting alterations in vision; others suggested operation, either iridotomy, iridectomy, or discission of the lens. He also asked what was the ultimate end of these cases. Did the patients survive until adult age, or did a complication supervene?

THE PRESIDENT said he had operated upon two or three such cases, fixing the lens with one needle, and breaking it up with another. The cases did well in respect of the lens operation, but the vision was always subnormal, probably because there was some congenital amblyopia, which caused the lens to be out of place.

MR. HARRISON BUTLER spoke of having operated on some cases of the kind by a method advocated in America, following a preliminary iridectomy. This he described. In a case he did five years ago, there was now some shrivelling of the iris, but vision was now 6/18. If these cases were left, in some there was dislocation into the anterior chamber, and glaucoma; in others the lens dropped into the vitreous and caused cyclitis.

MR. GREEVES spoke of having operated upon cases with a Ziegler knife, and vision improved from below 6/60 to 6/18 or 6/12.

MR. LEIGHTON DAVIES said the decision whether to operate or not should largely depend on whether the edge of the dislocated lens lay outside the pupillary area when the pupil was contracted. If it came just to the pupil, the case was better left alone. In a young child it was better to do needling than a large operation like extraction.

Cavernous Angioma of Orbit.

MR. LESLIE PATON showed a case of

cavernous angioma of the orbit, with microscopic slides. The patient was aged 76, and there was no trace of anything wrong until she was over 70. He found a growth the size of a walnut; but it was encapsulated, and came away very nicely, without subsequent bleeding. At some stage in her life there had been a fracture of the upper margin of the orbit, and he wondered whether there was a connection between that and the much later development of angioma.

Detachment of Retina.

MR. PATON also showed a case of recurrent detachment of retina after 17 years of reposition. Since 1904 the man had had quite a number of operations. The eye in which the detachment occurred was of normal refraction.

Discussion.—SIR RICHARD CRUISE related a case in his experience which had reattachment of retina after ten to twelve years of complete detachment. There had been no shrinking, and therefore there was a readjustment of the retina to the concavity of the sclera. This also was in an eye of normal refraction.

Bilateral Proptosis.

MR. R. A. GREEVES exhibited a man, 37 years of age, who had bilateral proptosis, dating from a year ago in one eye, and five months ago in the other. His trouble was double vision, especially on looking upward. The question was whether it was a case of Graves' disease; he did not think that was probable. There was a tremor of the hands, but no tachycardia or thyroid enlargement.

THE PRESIDENT and MR. REA favored the idea of exophthalmic goiter.

Operation for Contracted Socket.

MR. OLIVER showed a patient on whom he had done a very successful plastic operation for contracted socket. In order to obviate the continued discharge and subsequent contraction often seen in these cases, he removed the whole of the conjunctiva, including that of the lids themselves; in this case he took away everything down to the periosteum. The man could now wear an artificial eye. The method was applicable to cases of exenteration of the orbit, in which there was no need to remove the lids. If skin grafting were resorted to, it was important to skin graft the under surface of the lids.

THE PRESIDENT congratulated Mr. Oliver on his result.

Macular Degeneration.

MR. FRANK JULER showed a girl, aged 15, the subject of macular degeneration associated with mental deficiency. The disease seemed to start at the macular region in both eyes. The vision had been very defective three years. Earlier the optic discs were pale, of the waxy type of atrophy. The pigmentary changes in the periphery were now more marked than formerly. There was no history or sign of syphilis in the child; but the mother gave birth to a premature child, then to one which died in 14 days. Before her sight became bad, this girl was in the lowest standard at school; and now she was attending a school for the blind; she was unable to learn like the other children did. He asked for views as to whether this was atypical *retinitis pigmentosa*, or a very chronic *syphilitic retinitis*, with secondary atrophy of the nerve, or a case of Batten's cerebromacular degeneration. There was no parental consanguinity.

Optic Neuritis with Gumma of Base.

MR. RAE showed cases of ruptured ligamentum pectinatum, and of gummatous exudation at the base of the brain, optic neuritis, and diplopia. In regard to the second case, he spoke of a case in which Sir Charles Ballance did a decompression operation. The Wassermann reaction was positive. Within a fortnight of the operation, the papill-edema had almost disappeared, the paralysis had gone, and the woman was now at work. Following the operation, the patient was thoroly treated with antisyphilitic remedies, the novarsenobillon being followed by mercury and iodid.

H. DICKINSON.

NETHERLANDS OPHTHALMOLOGICAL SOCIETY.

Fifty-ninth Meeting.

PROF. G. F. ROCHAT, Presiding.

Translated by Dr. E. E. Blaauw.

Papillary and Retinal Tumors in Tuberous Sclerosis.

J. VAN DER HOEVE demonstrated microscopic specimens of a tumor of

the optic papilla and of different retinal tumors of two patients suffering with cerebral tuberous sclerosis. The tumors originate in the nerve fiber layer and the layer of the ganglion cells; the other parts of the retina are normal; only at one spot the inner nuclear layer was invaded and replaced by a tumor He demonstrated the edematous degeneration or cystic changes of the retina, the cysts, hemorrhages, degenerations and calcareous incrustations of the tumors, in which were also present blood pigment, hemosiderin and hematoidin crystals. The tumors are built up by nervous fibers and embryonal cells, which are not yet differentiated into ganglion cells, as are found in inverted retina with orbital cyst and microphthalmus, according to Fuchs.

Van der Hoeve observed, in vivo, parts separate from the tumor; in the sections separated, proliferations of the tumors are seen, free parts in the vitreous and on the lamina vitrea. Some tumors that lay at the outside of the lamina vitrea without a connection with the underlying retina could be seen. He supposed that here a sowing of the tumors on the retina along the vitreous was visible. The tumors belong to the neuromas.

Discussion.—VAN DER HOEVE answered Nicolai, that these particles contain apparently viable cells, which find a favorable condition for further development, so that this growth is not surprising. He answered Rochat, that it is diffiuclt to determine if it should be called glial or nervous tissue, as the tissue of these tumors have an embryonal type. They certainly do not belong to the gliomata.

Late Infection after Trephining.

G. TEN DOESSCHATE demonstrated a case of "late infection," 22 months after scleral trephining. Panophthalmitis was present. The pus apparently formed in the neighborhood of the trephine scar and spread from this out in the eye. Microscopically the scar was entirely filled with polynuclear leucocytes. The anterior chamber in the neighborhood of the scar was full of pus, which could be followed thru the entire eye. Lens and retina were nearly entirely covered with leucocytes. In the excavated papilla pus is conglomerated, while in the surrouning of the papilla the membrana limitans is pushed away from the rest of the retina by a layer of leucocytes. Bacteria were not found in the sections.

Hyalin Degeneration of Cornea.

G. TEN DOESSCHATE reported: In a corneal staphyloma, originating after keratoscleritis, a great number of shining and transparent small globes and bifurcated beams of different sizes are seen. They are considered to be "hyalin" according to the color reactions. The degeneration product lies partly between the epithelial cells, but for its largest part in the stroma. The cornea around is infiltrated with polynuclear leucocytes, which lie in great number against the hyalin mass and suggest a chemotactic attraction. Also a beginning keratitis zonularis is found in the cornea.

Retinitis Pigmentosa in a Dog.

Ten Doesschate said: This affection seems very rare in animals. It begins in the periphery of the retina, and the external layers of the retina suffer first. The retinal degeneration was seen ophthalmoscopically.

Discussion.—VAN DEN BORG thinks that as in the sections the leucocytes progress along distinct lines from the corneal wound towards the disc, the heaping up of the leucocytes in the excavation takes place, as is seen so often after traumatism of the anterior part of the eye. This induced papillitis can be made experimentally by bringing staphylococci or other microbes into the anterior chamber.

SYPKENS asks if a connection exists between the hyalin degeneration in the cornea and the vascular distribution. Or is the stroma also degenerated? If the hyalin degeneration is connected with the vessels, the presence of the leucocytes is not surprising, because an inflammation will have existed first, where we can expect most leucocytes near the vessels.

TEN DOESSCHATE replied, that in this specimen it cannot be made out with certainty along which way the infection travelled toward the disc. He

also stated that the location of the leucocytes is not connected with the course of the vessels.

Opacity of Cornea and Buphthalmos.

P. J. WAARDENBURG showed a Jewish boy of one year, the firstborn of healthy nonconsanguineous parents. The mother suspected that the child could not see well, and that it had pain in the eyes in attacks, when a transient redness and tears appeared. The family physician stated, that the child from the first weeks on had shown grayish-white spotted corneas. There was convergent squint, and nystagmoid motions. The corneas in the center were nearly milk white, becoming more transparent toward the borders. The periphery was transparent, no vascularization in the cornea or vascular injection. Diameter of cornea: 11.25 mm. The anterior segment was not enlarged; an observable enlargement begins at the equator. The pupils were narrow. Tension seemed increased, +2; the media were opaque. Only a dirty red fundus reflex was visible.

After 5 days of pilocarpin instillations the cornea became clearer. The child was more quiet and saw large objects before the eyes. The tonometer registered about 35 mm. Iridectomy O.S. in narcosis March 15; of O.D. on March 24. In narcosis T.O.S. was found 12 mm. Iridectomies with v. Graefe's knife; the iris prolapsed only slightly. It remained impossible during the following weeks to see the fundus on account of the clouded media. The fundus is only visible thru the coloboma. Wassermann negative. Opacity cleared and did not recur.

The case differs from the usual picture of buphthalmus, in that the corneas are little enlarged, the anterior chamber moderately deep, pupils narrow, limbus not broadened, no Descemet fissures; during the operations not much aqueous escaped. From these symptoms a moderate degree of just beginning glaucoma with slight functional disturbances should be diagnosed. The corneal opacity can only be compared with the clinical condition described by Peters as porcelain white, congenital central corneal opacities. He mentions that they become in time more transparent, but not so rarely are followed by slight buphthalmus. He and Hirschberg noticed a quick clearing up and lowering of the tension after iridectomy.

W. asks, what is the connection between the opacity and the rise in tension? Has the tension become normal thru the operation? If not, then the examination in narcosis produces unreliable data, which he had seen previously in a boy with iridokeratitis from lues, whose irritated eye only became quiet after iridectomy, altho the tension was normal.

W. suggested that this glaucoma was caused by a very rigid sclera, poor in vessels. Perhaps the entire vascularization of the globe was deficient and this could partly explain the hardness of the coats and the disturbances of nutrition of the media; the irides did not bleed during the operation. Strange was the narrowness of the pupils and the absence of reactions during the interventions.

Discussion.—SNELLEN diagnosed buphthalmus. It was not clear to him why W. called it infantile glaucoma.

WAARDENBURG wished to point out the absence of distension of the anterior part. He thought it a transition toward hydrophthalmus, which had not become entirely developed.

Anomalies of Tear Passages.

J. VAN DER HOEVE gave results of investigations, which he has published. (See A.J.O. v. 5. p. 211.)

Visual Acuity.

C. OTTO ROELOFS. (v. Graefe's Arch. p. 151.)

Rodent Ulcer of Conjunctiva.

N. J. CUPERUS showed a 54 years old man, complaining during 6 years about pain now and then in the lower lid O.D., with some secretion and photophobia, and since 2 years of O.S. in a lesser degree. A triangular white spot was seen on the conjunctiva, on everting the lower lid. The base was parallel with the lid border and covered about the middle third. The white color of the ulcer depended on an exudate, which covered its bottom, the

margins were slightly infiltrated, a slight contraction of the skin of the lid was present.

Discussion.—BLOK asked if microscopic and serologic examination was done. On the left side keratitis pannosa is absent. The right ulcus has received 3 times 20 minutes radiation with 4 mgr. mesothorium, with successful result, which speaks in favor of the diagnosis.

VAN DEN BORG thinks the lumbar fluid should be examined on account of the luetic appearance of the ulcer. Wassermann negative.

VAN DER HOEVE would also have done scraping, or exploratory excision. He considered the diagnosis of rodent ulcer the most probable.

ROCHAT would consider pemphigus, on account of the scars in the conjunctiva.

CUPERUS replied that no other signs or lues or tuberculosis had been seen; that the long duration (6-7 years) and the favorable action of the radium suggests to him as the most probable epithelioma. He asked if the pemphigus infiltration is present.

Treatment of Ocular Diseases with Milk Injections.

L. BIERENS DE HAAN gave the results from the literature. He himself treated a man for his 7th recurrence of iritis, who had not been able to work for 8 months. After 2 injections he asked to resume his work. Another case of iritis with very many vessels in the iris tissue did not need any atropin after 8 days, thanks to 2 milk injections. Nearly all writers are unanimous as to the good results of milk injections in iritis. De Haan referred to the favorable results in gonococci conjunctivitis, ophthalmia neonatorum. Wolff had used typhoid vaccine in a cloudied cornea and ulcer, without success, altho it had helped previously. He had treated two children with blennorrhea with milk. One was cured quickly, but the other no more quickly than with the classical treatment.

PROF. ZEEMAN had sometimes a very favorable improvement in posttraumatic or postoperative infections.

DE HAAN likes to give the injections in doses of 5, 7 and 10. Anaphylactic shock does not appear, if the first injection is not larger than 10 ccm. and the next not later than the 2d. or 3d. day. If after some months one wishes to repeat, one should begin with 1/2 cc.

If the injection is given early in the morning, then the fever begins in the middle of the day and at night the temperature is nearly normal again. The milk is no panacea against all possible ocular diseases, but we have in it a powerful adjuvant in some very dangerous ocular diseases.

Discussion.—WISSELINK asked if the speaker had experience with aolan and such preparations, and if it is not indicated to inject every day.

DE HAAN considers daily injections unnecessary. He has no experience in dacryocystitis or with subconjunctival injections. He considers shortening of the process in conjunctivitis neonatorum an advance, but certainly the good action in adults was the most important indication of the milk injections.

FLIERINGA was interested to hear, that this treatment seems harmless; Prof. Storm Van Leeuwen warned him that imminent death was possible with it. He has used it with 4 patients with retinitis albuminurica, and saw enormous improvement of the vision, which only remained for a short while.

HOUWER was impressed with the fact that the number of gonococci the day after the injection was larger than the day previous; he surmises, that the useful action must not be explained by direct influence on the microbes but by neutralizing of the poison.

VAN DER HOEVE asked as to recurrences after this treatment, and the action in urethritis.

BIERENS DE HAAN replied that recurrences do not seem to happen oftener: that the milk therapy is not advocated in urethritis, but in arthritis and other endogenous localisations.

Movements of the Isolated Iris.

JASPER TEN CATE mentioned that the automatic movements of organs outside the body seem to be due to unstriped

muscle cells, and nervous plexus and ganglia. As the iris possesses numerous unstriped muscle fibers and a well developed ganglia apparatus, Ten Cate investigated the automatic rhythmic movements of the isolated iris.

A straw on a glass rod served as lever. A thin silk thread, somewhat twisted, connected to the two ends of a glass fork, served as fulcrum. The iris pulled at the end of the glass lever. The displacement of the end of the straw was enlarged 16 times, and was registered by placing the instruments before the slit of a photograhic apparatus in the light of a projection lantern.

Chiefly cat's irides have been used. They were quickly prepared and kept in tyrode solution at 37-38° C. Glycose had an unfavorable influence, so that tyrode without glycose was used. Addition of oxygen shortened the isolated iris strongly, but the spontaneous movements were much weaker than when no oxygen was added. The optimal temperature was 37-38° C. This iris showed two sorts of movements: 1. rather strong, very slow, which apparently were analogous to the "tonus-swingings" in the literature. 2. much weaker, more frequent movements, which distinctly are related to the "spontaneous, rhythmic movements" of isolated organs. They were not regular, 16-29 contractions per minute.

Pilocarpin and cholin make these movements and tonus-swings stronger, while adrenalin weakens them and atropin stops them. The rhythm under pilocarpin becomes 25-38 contractions per minute; under adrenalin 4-8.

Separate Muscle of Ciliary Body of Pigeon.

J. H. Salmann found and described the muscle in the nasal under quadrant in horizontal sections; this quadrant contains the eye-slit and the muscle bundle in oblique direction. If one sections this quadrant radially, according to an angle of 45 degrees with the horizon, then the muscle is found in its greatest length.

American Journal of Ophthalmology

Series 3, Vol. 6, No. 2 February, 1923

PUBLISHED MONTHLY BY THE OPHTHALMIC PUBLISHING COMPANY

EDITORIAL STAFF

EDWARD JACKSON, Editor,
217 Imperial Bldg., Denver, Colo.
M. URIBE-TRONCOSO,
143 W. 92nd St., New York City.
MEYER WIENER,
Carleton Bldg., St. Louis, Mo.
CLARENCE LOEB, Associate Editor,
25 E. Washington St., Chicago, Ill.
CASEY A. WOOD,
7 W. Madison St., Chicago, Ill.
HARRY V. WÜRDEMANN,
Cobb Bldg., Seattle, Washington.

Original papers, correspondence, and other scientific communications should be addressed to the Editor. Books for review may be sent to any member of the editorial staff. Reports of society proceedings should be sent to Dr. Harry S. Gradle, 22 E. Washington St., Chicago, Ill. News items should be sent to Dr. Melville Black, Metropolitan Bldg., Denver, Colo.

Proof should be corrected, and returned within forty-eight hours to the printers. Reprints may be obtained from the printers, Tucker-Kenworthy Co., 501 S. La Salle St., Chicago, Ill., if ordered at the time proofs are returned. But reprints to contain colored plates must be ordered when the article is accepted.

Copy of advertisements must be sent to the Manager by the fifteenth of the month preceding its appearance.

Subscriptions, applications for single copies, communications with reference to advertising or other business, should be addressed to the Manager of Subscriptions and Advertising,

JEAN MATTESON, Room 1209, 7 West Madison Street, Chicago, Ill.

THE OCULAR MOVEMENTS.

The five papers dealing in different ways with these movements, which are published in this issue, indicate that ophthalmologists are still studying the disorder of ocular movements, with the feeling that the problems they present have not yet been fully solved. A close examination of these papers shows widely separated points of view, with corresponding differences in what appear to the different writers as the most important facts. Opinions directly opposed to one another, on definite questions of theory or fact, are still held by thoughtful men of large experience.

By these different and opposing views brought into close contrast, we can at least be reminded that the subject is broader than any one writer or reader has yet appreciated. Careful thought has lead one in a certain direction to facts of value that lie beyond the usual text-book survey of the subject. The study and experience of another have reached a similar result in a wholly different direction. The important lesson is forced on our attention that the thinking and observation of each individual is carried along on too narrow lines. Each observes some facts that others do not, but he also fails to observe other things, that some of his confreres deem most important.

The kind of papers most needed on this subject are papers recording more exact and extended observations. One writer has reported so many hundred cases of squint, with a certain percentage of "cures;" but without any definite statement of what constitutes a "cure." How many of these "cured" patients had full fields of fixation; how many habitually used the binocular vision that they had? Was the fusion sense dominant in all their ocular movements, or did it only control them at times? To what degree was the power of binocular vision developed; could they just become conscious of the double images of a bright light in a dark room, could they just perceive relative "depth" of gross objects; or could they show a normal ability to judge relative distance by refined modern tests for depth perception?

A few cases reported, with inclusion of all the facts that we have learned to

recognize as significant with regard to ocular movements, would be worth more than many hundreds of reports of "cures," such as we find in the literature; even altho these reported cures are supported by photographs showing that the cosmetic defect, the deviation from the normal appearance of the eyes in human beings, has been removed.

In the absence of such reports, the best we can offer in the literature of ocular movements are the ripened conclusions of colleagues, who have long observed their patients closely, according to the older methods; and have thought deeply about the work they were doing. Such conclusions are the outstanding characteristics of the papers published in this issue. We can try to understand these views from reading, and then we can put them to the test of experiment in actual cases. The careful watching and recording, *to the end*, of one such case, noting carefully and fully its progress thru many years, as to development both before operation and afterward, even if such case record is never published, will have a very high educational value for the observer and recorder.

The papers on cataract extraction, three of them in this issue, illustrate how it is possible to watch every complication and outcome of an operation. But the cataract operation is a comparatively standardized operation, done for hundreds of years, generally on old people, with little chance of further development. Squint develops with the developing organism, is operated for in early life, when further development and the occupations and occurrences of a lifetime are likely to modify the results. It is more worthy of such minute study as has been given to cataract.

Comitant squint is a disorder of coordination, a fault of the central nervous system, not of a muscle. The emphasis placed on this by the veteran Landolt may help to correct the error perpetuated by writing about the "squinting eye" or the "contracted" or "weak muscle." Full appreciation of this may carry the student even further than Landolt has gone. Alexander's analysis of "vergence" follows lines that differ from the teachings of Stevens, or of most textbooks. They must prove suggestive to all who carefully consider them. The conclusions of McCool and Fox are those of practical experience. They suggest that there are still facts that must be harmonized with theories before these can be accepted as established. The review of some things that have actually been done in the way of transferring a particular function from one muscle to another must prove suggestive to any one who carefully considers it.

Some of the most advanced work with regard to ocular movements has been done in America, by physiologists as well as by ophthalmic surgeons. This is being admitted by the space given in recent European journals to views heretofore considered strictly American, and is indicated by the invitation of an American to open the discussion of this subject before the Section on Ophthalmology of the British Medical Association. It is greatly to be desired that the studies and discussions and teachings in regard to ocular movements shall still go forward in America to greater exactness, broader coordination, more definite reasoning, and the test of intelligent, rigid, clinical experiment.

E. J.

PASTEUR AND EXPERIMENT IN OPHTHALMOLOGY.

The centennial celebration of the birth of Louis Pasteur (December 27, 1922), who laid the foundations for scientific medicine and surgery, should bring to the mind of every student and practitioner of ophthalmology some appreciation of the real character and importance of scientific experiment. Pasteur was trained in physical science; and especially chemistry, at the time when exact experiment had just placed it on a truly scientific basis. He carried over into his biologic investigations of fermentation, alleged spontaneous generation, putrefaction and disease, a supreme faith in the value

and importance of experiment. He developed experimental methods, rigid, ingenious and most simple, that revealed the part played by microorganisms in chemical and biologic processes. Thus he made medical science a fact, where before it had been only an inspiring hope or dream.

A fruitful clinical experiment does not mean the mere trial of some drug, or manipulation, or interference with the course of nature, that no one has reported to have tried before. It means close observation, careful recording, painstaking investigation of minute details, until everything bearing on the conditions of the experiment is definitely known. Every observable character of the disease must be determined; and its course known, with exactness and all possible completeness. Then, by the simplest method, some one chosen condition is to be altered; and the effects of that alteration observed and recorded with the same persistent attention and painstaking care. This must not be with the hope of supporting a hypothesis, that might bring fame to its originator; but wholly to learn the exact truth.

Pasteur made definite notes of every experiment he performed; and across the test of many an hypothesis he wrote "erroneous." His absolute intellectual honesty and willingness to accept the fact, whatever it seemed to prove against his previous suppositions, saved him from countless mistakes, and gave his reported observations the value of confirmed discoveries. Pasteur opened new fields of science. He also opened new possibilities of investigation and progress in every known field, by his examples of what scientific experiments ought to be.

Progress in ophthalmology, as in any other branch of science, consists in adding new knowledge to what was known before. To apply the methods of original investigation, to discover over again what has already been discovered, is a great waste of time. No one can hope to contribute something new to the general fund of knowledge, until he has mastered that which has already been accumulated and recorded in the direction in which he proposes to investigate.

But his knowledge must not be restricted to a narrow special field. It was Pasteur, the chemist, who created bacteriology, and profoundly modified all conceptions of biology. It was Helmholtz, the physicist, who devised the ophthalmoscope and opened the era of modern ophthalmology. It was Donders, physiologist and physician, who pointed out to ophthalmologists the pathologic importance of anomalies of refraction, previously left to the care of optician.

An advance in ocular therapeutics is not brought about simply by applying a new drug to the conjunctiva and writing that the patient was cured. There are thousands of pages of such statements that simply add to the confusion of the student. To make his experiments worth recording, one must be thoroly familiar with the natural history of the disease, its course as run when it is untreated, and the modifications in its course produced by methods of treatment that have heretofore been applied; also, the departures from the usual course that might be expected in the particular case, on account of peculiar circumstances of the patient or the infection. If to this is added a general appreciation of the action of drugs of its class, the changes in action to be expected from variations in strength of solutions, frequency of applications and differences of the stage of disease; and if to all this knowledge, and to trained powers of observation, honesty of judgment, that will not be mislead by desire of favorable effects, there is a chance of valuable results from clinical experiment.

If you wish to prepare to add to the knowledge of ophthalmology by clinical experiment, learn all that others have learned before you about clinical ophthalmology; and practise discriminative consideration, and honesty of judgment as to results attained, every day of your professional life. Discoveries are made only by those who know the previous discoveries that lead up to them. They stand the criticism

of colleagues and rivals only when they have stood the most rigid, absolutely candid, criticism of the well informed discoverer.

The road to real advance by clinical experiment is long and difficult; it is travelled to success only by those who, like Pasteur, are ready to "work, work, evermore work." But it is open to all who practice ophthalmology, and it must be travelled to some extent by all who would be successful practitioners. It leads to wide knowledge, exact discrimination and sound judgment as to therapeutic resources. The preparation for sound original investigation is the preparation for successful practice. Every case should be a problem in original investigation. Such investigation is what makes the trained specialist a better adviser than a patent medicine advertisement, or the label on a bottle.

Each prescription or local application should be a clinical experiment, performed with the same care, and judged with the same exact discrimination and honesty, as bring success in laboratory investigations. When this is more generally understood and acted upon, the amount of literature exploiting new remedies, either drugs or operations, will be diminished, but its value will be much greater. As conscientious thoroness dominates in practise, scientific progress will grow out of it, both for the individual practitioner and the profession.

It is not meant that financial success and high scientific achievement necessarily go together. The effective scientist can be reasonably sure of a living, whether he be an investigator, a teacher, or a practitioner; but he cannot expect to leave a large fortune. Lasting fame is not just the thing that brings fortune. Present fees are not paid for work that is done for the future. The ophthalmologists of a country can only achieve leadership in ophthalmic science by giving a share of their labor to solving problems for which no money prizes are now offered. But the respect of one's colleagues, the sense of true accomplishment, the feeling of security in knowledge and reputation are worth as much as money. A balanced ambition will seek a share of each. The intellectual development that comes by making each case a subject of clinical study and experiment is worth more than either fame or fortune.

E. J.

BOOK NOTICES.

Anomalies and Diseases of the Eye. Nettleship Memorial Volume. By **Julia Bell**, M.A., M.R.C.S., L.R.C.P. Being volume II of the **Treasury of Human Inheritance,** edited by **Karl Pearson,** F.R.S. Quarto, 140 pages. Frontispiece, 1 color plate and 366 pedigree charts. Cambridge University Press.

This constitutes number 21 of the memoirs issued from the Francis Galton Laboratory for National Eugenics, of the University of London. The war caused a suspension of this series of pedigrees of hereditary eye diseases and anomalies of the eye; and left the finances of the laboratory impaired. Both research work and this publication of results have been made possible by help granted by the Medical Research Committee. Now that this part is before the public, it is to be hoped that its value will bring support from English speaking countries thruout the world, which profit by it equally with Great Britain. Other sections of the volume are in preparation, and their early issue depends on the interest this part develops.

In his prefatory note, Karl Pearson thus expresses a thought which the reviewer has repeatedly emphasized. "The one branch of medical science wherein the importance of hereditary studies has been fully appreciated and wherein splendid work has been done during the last decade is, undoubtedly, ophthalmology, and none can hesitate to admit that the main incentive towards this great achievement was the inspiration provided by Nettleship." Such appreciation of the importance of Nettleship's work in this direction runs all thru Pearson's preface. But having known him only in his

later years, the Editor has called on J. B. Lawford, who, from his intimate personal association with Nettleship and broad acquaintance with ophthalmic science, has produced a biographic sketch that will be a satisfaction and an inspiration to all ophthalmologists.

The chapter on Retinitis Pigmentosa and Allied Diseases, by Dr. Bell, includes an account of congenital stationary nightblindness and choroideremia. It contains, besides historical data, sections on signs and symptoms, pathology, diseases and defects in association with retinitis pigmentosa; its racial and geographic distribution, statistical relations and consanguinity. Among the conditions allied to retinitis pigmentosa are mentioned chorioretinitis, retinitis punctata albescens and choroideremia. The fundus appearances of the last named condition, in Usher's case, are beautifully reproduced in the colored plate. (See also plate XII, A. J. O. 1919, v. 2, p. 553.) The section on congenital stationary nightblindness brings out its clinical characteristics and hereditary groupings. Of its pathology nothing is yet known.

The bibliography of this part includes 328 references, arranged chronologically; beginning with one to the Papyrus Ebers, and ending with one to the American Journal of Ophthalmology for 1921. It is accompanied by a name index of the authors, who have published papers or pedigrees.

Then come 56 pages of descriptions of the pedigree plates. After this come a dozen pages on glioma of the retina —a general account of it, bibliography, authors' index and description of pedigree plates. The 26 plates giving charts of 366 pedigrees complete this part of the volume. These charts have been drawn by Miss H. Gertrude Jones, and each carries its own explanation of signs used; and certain data, as the name of the reporter, consanguinity or its absence, the existence of mental defects, early death, etc. The frontispiece is a reproduction of a splendid photograph of Edward Nettleship.

This volume will not be regarded as an essential in the equipment of most practitioners of ophthalmology; but it should be in every important library, medical and general as well as ophthalmic, for it contains important records in condensed form of the most exact definite observations regarding human heredity that are available for the study of all who are interested in biology or eugenics.

E. J.

Practical Medicine Series, 1922. The Eye, Ear, Nose and Throat, volume 3. Edited by **Casey A. Wood**, C.M., D.C.L., **Charles P. Small**, M.D., **Albert H. Andrews**, M.D., and **George E. Shambaugh**, M.D., 12 mo., 453 pages, 28 plates and 24 illustrations in the text. Chicago, The Year Book Publishers.

Of this neat volume, 212 pages, 23 plates and 19 of the other illustrations are devoted to the diseases of the eye, the two color plates are reproductions of plate I, v. 5, of this journal; about one-half of the volume is devoted to ophthalmology.

Dr. Wood's introduction to this part also introduces his colleague, Dr. Small; and points out, that from the great mass of literature, those items have been chosen "that are likely to interest the general practitioner." But it is hoped the specialist in ophthalmology will find that the more practical of the papers on his subject are here represented.

The text is arranged under headings, beginning with congenital anomalies, examination of the eye, refraction, the ocular muscles, and other topics much as in our lists of current literature; but concluding with surgery of the eye and orbit, new instruments, ocular therapeutics and miscellaneous ophthalmologic articles. The longer sections are on sclera and cornea and on therapeutics, each 24 pages; those on ocular injuries and foreign bodies, and on surgery of the eye and orbit, each 18; that on miscellaneous articles, 14; and those on the examination of the eye, the iris and the choroid and retina, each 12.

The space devoted to the eye and its diseases is greater in this than in preceding volumes of the series. The selec-

tion of literature to be abstracted has been excellent for the purpose in view. It would be hard to use an equal number of pages (containing about as much as 100 pages of this journal) to better advantage. E. J.

Augenaerztliche Operationslehre. T. Axenfeld and **A. Elschnig,** with twenty collaborators. Two volumes, 8 vo., 2251 pages, 1142 illustrations. Berlin, Julius Springer.

These great volumes, devoted to ophthalmic operations, are published as part of the second and third editions of the "Graefe-Saemisch Handbook." The second edition is still incomplete, while for certain volumes the third edition is being issued. The appearance of these volumes, as belonging to both editions, emphasizes the fact that this work is strictly a collection of monographs; and while they are all comparatively complete and well written, each has a special value determined by the thoroness of those who have compiled it. The authors of this work are well known; the best brief indication of its character can be given by a list of the different parts, the pages given to each and the names of the author or authors.

The general portion, 136 pages, is by Franke (Hamburg). It takes up instruments, operating room, preparation, fixation, hemostasis, sutures, dressings and after treatment.

Operations on the lids, 324 pages, is chiefly by Loehlein (Greifswald). But Elschnig (Prague) writes on ptosis, Gruenert (Bremen) on ectropion and blepharoplasty, Axenfeld (Freiburg) on symblepharon, and Löwenstein (Prague) on chalazion, repair of injuries, etc.

Operations on the conjunctiva, 29 pages, is by Peters (Rostock). The cornea, 132 pages, Kuhnt (Bonn). General opening of the anterior chamber, 6 pages, Elschnig. The skin, 25 pages, Cords (Cologne). Operations on the iris, 116 pages, Kuemmel (Hamburg).

Glaucoma operations, 187 pages, are treated chiefly by Koellner (Würzburg) but Heine (Kiel) writes on cyclodialysis, and Wessely (Würzburg) on fistula forming operations. Operations on the crystalline lens, 325 pages, are chiefly described by Elschnig; but Igersheimer (Goettingen) takes up operations for myopia.

Operations on the choroid, retina and vitreous, 94 pages, are described by Lenz (Breslau). The operative treatment of foreign body wounds, 120 pages, is written by O. Haab (Zurich). Operations on the lacrimal apparatus, 84 pages, by Fleischer (Erlangen). Operations on the ocular muscles, 176 pages, are treated by van der Hoeve (Leiden).

Enucleation, exenteration, prosthetic and allied operations, 93 pages, is the work of Sattler (Koenigsberg). Artificial eyes and protheses, 38 pages, is also by Sattler. Operations on the orbit, 66 pages, comes from Birch-Hirschfeld (Koenigsberg); and the surgery of the nasal sinuses, 109 pages, from Linck, of the same place. The operations of general surgery to meet certain emergencies and conditions, 95 pages, are taken up by Schloffer (Prague).

The references have been brought up to date, many to papers in 1921, and some to papers published in 1922. The contributions of American writers have been generally noticed and referred to. About 30 per cent of the papers on muscle operations come from the United States. The subject index occupies forty-four pages, double column. The index of authors cited takes thirty pages. In the latter it is rather striking to find no mention of Herman Knapp. A few of his earlier papers are referred to under J. H. Knapp. But all the others seem to be thrown under the name of Paul Knapp. In this collection credited to Paul Knapp (134 references) are also included what should be credited to Arnold Knapp, and others of that name, altho one is credited to "Knapp Jr." The custom common in journals of continental Europe of publishing articles with only the last name attached is certain to favor this kind of confusion. This error seems to have arisen from this defective system of mentioning authors. The references scattered thru the text are all simply to "Knapp" or "Nettleship" or "Daviel," etc. In an annual bibliography for a year book, where two of the same patronymic rarely write on the same subject the same year; *and*

where the initials are given in the bibliography, the method does well. But in a work of this size, covering the whole history of the subject, it is very unsatisfactory; and it is impossible for one who is indexing such a book to discriminate among the different individuals.

It would not be practical to have each surgeon read about all the different forms of an operation that have been tried, before he first undertakes to do it. But it would be a great gain to students and readers, if every man, who intends to describe what he thinks is a new operation or a new instrument, could be compelled to toil thru all the descriptions of similar operations and instruments, before he published his description of his own. E. J.

Transactions of the Section on Ophthalmology, American Medical Association. Meeting of 1922, 382 pages, 38 plates, 9 in colors and 17 illustrations in the text. Chicago, American Medical Association.

This volume, which might be numbered 32 in its series, is quite up to the standard set by its predecessors of recent years. There is a notable group of 3 papers on the ocular conditions associated with nephritis and vascular hypertension, with an abstract of more than 6 pages of the discussion that they evoked. One of these papers by Martin Cohen includes 23 photomicrograph plates that illustrate magnificently some of the pathologic conditions found in such cases. The other papers, by Benedict and Behan, add much of interest to our knowledge of the subject.

The paper of Van Kirk on "Industrial Ophthalmology" was based on a survey of 25,000 cases. The discussion on it by 8 other speakers is about as long as the paper, the whole constituting the kind of symposium that is only possible where the previous printing of the paper renders it accessible to all who may wish to discuss it. To this might be joined the paper by Patten on the localization and extraction of intraocular foreign bodies, with 6 pages of discussion by 9 speakers that accompanies it. The two together give a good reflex of present day practice with regard to the prevention and treatment of the most common of industrial injuries.

Perhaps the most striking paper in the volume is that of Bedell on the iris in health and disease as seen with the slit lamp; illustrated, as it is, with 13 pages of plates giving 36 different figures, of which 21 are in colors. The earliest literature of slit lamp microscopy opened up the wonders which brilliant controlled illumination revealed in every part of the eye accessible to focal illumination. More and more this literature will be diffused thru all descriptions of ocular symptomatology and pathology. This paper is probably the most striking American contribution on the subject that has yet appeared. Its representation of pigmentation in various conditions, and of the more common anomalies of persistent pupillary membrane are especcially beautiful.

The reports of the Committee on Estimating Compensation for Eye Injuries have been alluded to elsewhere (v. 5, 1922, p. 763). Both reports are here printed in full, with the remarks of Dr. Snell in support of the latter. But the illuminating general discussion participated in by 9 members of the section is not given. At its close the majority report was approved, and the Committee continued.

The lengthening series of these volumes of transactions fully maintains its high standard of scientific value.

E. J.

Brain Abscess, Its Surgical Pathology and Operative Technic. Wells P. Eagleton, M.D., Lt. Colonel, M.R.C. The MacMillan Company, New York, 1922.

This is a monograph of 297 pages including the appendices, well printed, illustrated, and bound—a guide for detailed clinical examinations reported from 1857 to 1919; an analysis of pathologic conditions in one hundred and twenty-five cases of cerebellar abscess; the analysis of one hundred and forty cases of frontal lobe abscess; and ex-

haustive indices and list of authors and subjects.

The book bears the evidence of the author's personality, being the result of considerable intradural experience, combined with bitter disappointments, failures and recoveries, and the results of some animal experimentation and postmortem observations. The ordinary surgical technic applicable to other parts of the body is insufficient to combat successfully the unique physiologic features and pathologic changes within the dura. Intracerebral abscesses should be in a class by themselves. The problems of surgical treatment differ distinctly from those of suppuration in other parts of the body, and are radically different from those encountered in nonsuppurative lesions of the brain. The success of intradural surgery will depend always upon utilizing every advantage offered by the preventive and reactive efforts of nature, while a single technical error may mean the loss of the patient's life, or at least of his subsequent usefulness.

The writer correlates the surgical treatment of the different pathologic lesions of brain abscess, showing that the surgical manipulation in each individual case must be adapted to the exact pathologic conditions present. The author has experience of more than fifty cases of brain abscesses, and gives the technic of the various procedures.

While the question of brain abscess, wherever it may be, is not directly an ophthalmologic subject, having more relation to diseases of the nasal sinuses and the ear; yet its diagnosis is so intimately connected with the conditions of vision and of the eyes, that it is well for the eye surgeon to be up to date in this particular at least. Especially significant of cerebral pressure, which is synchronous with pressure upon the veins within the skull, is the slow pulse, an occurence of ocular paralysis and papilledema, which are all of localizing importance.

The intense choking of the disc, so frequently seen in brain tumor, never occurs in cerebral abscesses. In temporo-sphenoidal lobe abscesses there are seen localizing symptoms, particularly shown in the visual field, in connection with aphasias, when on the left side. In cerebral abscess particularly are the vertigo, nystagmus, past pointing and falling of diagnostic value.

The book as a whole is readable and worthy of a place in the general and special surgeon's library. H. V. W.

Goerdt, O. End Results of High Myophia Operated Upon and Without Operation. Göttingen Thesis, 1919.

The author reports the histories of twenty-nine nonoperative cases; and of twenty-six which had been operated upon, the course of which has been observed for years. The operative procedure in the latter was, first dicission of the lens, followed by lens extraction. In twelve the extraction had to be preceded by puncture of the anterior chamber. Five times there were tour entries necessary, and in one case there were five secondary operations. Prolapse of vitreous occurred three times, and increase in intraocular tension four times.

In one case there was a direct glaucoma, followed nine years later by detachment of the retina. In another case, it was followed ten years after, which can hardly be called a complication of the operation, as this occurs quite as often and more often in eyes that have not been operated upon, and where there is no infection of the eyes from operation. The percent of retinal detachment in those not operated upon is as great, and 75% of the latter had progressive loss of sight; while in those operated upon only 23% got worse. In those not operated upon, three necessarily became amaurotic and two became entirely blind.

Under the head of operative cases, there were two amaurotic cases, and one case in which the patient became totally blind. It seems, therefore, that the percent of betterment is considerably in advance in the cases operated upon. A fairly complete German bibliography is given. H. V. W.

ABSTRACTS

Sauvineau. Cerebral Causes of Strabismus. Centre Médical, May, 1920.

Stating anew his own conception of strabismus, and the treatment by complementary colored glasses, which he previously laid before the Academy of Medicine, Paris, Dr. Sauvineau explains further that, in strabismus, the convergence (tho it produces the most visible symptom, i. e., the ocular deviation), is but secondary. The original cause of strabismus lies in an affection of the cerebral power of fusion, due to heredity. Strabismus is equivalent to monolateral cerebral vision. Any squinter is *cerebrally one eyed.*

Consequently, the treatment must aim at the readjustment of the cerebral binocular vision. With the help of the complementary colored glasses, we develop the sensation of diplopia in the patient suffering from squint, that is the simultaneous vision; then the squinter must be taught how to fuse the double images thus obtained. The readjustment of the deviated eye will be obtained in addition, and relapses avoided. As a rule any case of strabismus can be cured by this method. However, if there be anatomic muscular alterations, or if deviation be extreme, an operation would be advisable (were it but from the point of view of saving time); on condition, of course, that the simultaneous vision be previously established. The operation in itself cannot cure strabismus, being but a part of the treatment.

H. V. W.

Dzen, T. T. Refraction in Peking. National Medical Journal of China. Dec., 1921, v. 7, p. 206.

Dzen has classified 1,150 patients that were refracted by the eye staff of the Peking Union Medical College. There were 576 Chinese patients and 574 foreign patients (that is members of the Caucasian race), so it is possible to make comparisons. The following tables included by Dzen in his paper is the best summary that can be given:

TABLE I

	Chinese		Foreigners	
Simple H. ...	32	5.55%	65	11.30%
Simple H. As.	19	3.30%	13	2.25%
Comp. H. As..	191	33.20%	312	54.35%
Simple M. ...	44	7.63%	3	.52%
Simple M. As.	7	1.20%	9	1.56%
Comp. M. As.	197	34.20%	76	13.41%
Mixed As. ..	41	7.10%	78	13.50%
Anisometropia	20	3.50%	4	.69%
Heterometropia	18	3.12%	8	1.38%
Emmetropia ..	7	1.20%	6	1.04%
Total ..	576	100.00%	574	100.00%

TABLE II

Hyperopia	Chinese		Foreigners	
0 to 1 D....	134	23.25%	156	27.18%
1 to 2 D....	92	16.00%	192	33.45%
2 to 3 D....	21	3.63%	58	10.10%
3 to 4 D....	4	.75%	20	3.49%
4 to 6 D....	5	.85%	14	2.40%
6 to 10 D....	8	1.40%	1	.17%
10 to 14 D....	3	.52%	2	.35%
Total ..	267	46.40%	443	77.14%

Myopia	Chinese		Foreigners	
0 to 1 D....	75	13.00%	35	6.10%
1 to 2 D....	52	9.00%	39	6.80%
2 to 3 D....	36	6.25%	17	3.00%
3 to 4 D....	27	4.65%	13	2.27%
4 to 6 D....	46	8.00%	15	2.60%
6 to 10 D....	38	6.50%	6	1.04%
10 to 21 D....	28	5.00%	...	.....
Total ..	302	52.40%	125	21.81%
Normal	7	1.20%	6	1.05%
Total ..	576	100.00%	574	100.00%

H. J. H.

NEWS ITEMS

Personals and items of interest should be sent to Dr. Melville Black, 424 Metropolitan Building, Denver, Colorado. They should be sent in by the 25th of the month. The following gentlemen have consented to supply the news from their respective sections: Dr. Edmond E. Blaauw, Buffalo; Dr. H. Alexander Brown, San Francisco; Dr. V. A. Chapman, Milwaukee; Dr. Robert Fagin, Memphis; Dr. M. Feingold, New Orleans; Dr. Wm. F. Hardy, St. Louis; Dr. Geo. F. Keiper, LaFayette, Indiana; Dr. Geo. H. Kress, Los Angeles; Dr. W. H. Lowell, Boston; Dr. Pacheco Luna, Guatemala City, Central America; Dr. Wm. R. Murray, Minneapolis; Dr. G. Oram Ring, Philadelphia; Dr. Chas. P. Small, Chicago; Dr. John E. Virden, New York City; Dr. John O. McReynolds, Dallas, Texas; Dr. Edward F. Parker, Charleston, S. C.; Dr. Joseph C. McCool, Portland, Oregon; Dr. Richard C. Smith, Superior, Wis.; Dr. J. W. Kimberlin, Kansas City, Mo.; Dr. G. McD. Van Poole, Honolulu; Dr. E. B. Cayce, Nashville, Tenn.; Dr. Gaylord C. Hall, Louisville, Ky.; Dr. Edward D. LeCompte, Salt Lake City.

DEATHS.

Dr. Otto Braun of Ashland, Wis., aged 56, died November 21st, from angina pectoris.

Dr. Leo Caplan of St. Louis, Mo., aged 57, died November 25th, in Vienna, Austria, from carcinoma.

Dr. Forest A. Carpenter of Statesville, N. C., aged 43, died December 2nd, from cerebral hemorrhage.

Dr. Charles H. Francis of Chicago, who has been in poor health for several years, died December 16th. Dr. Francis has been connected with the Chicago Policlinic, on the ophthalmologic staff, for many years.

PERSONALS.

Dr. and Mrs. L. Webster Fox have been spending the holidays in California.

Doctors J. H. Harter and H. V. Würdemann, of Seattle, have formed a partnership.

Dr. George E. Henton, of Portland, Oregon, returned recently from a six months' tour of European clinics.

Dr. F. Antill Pockley has resigned as lecturer in ophthalmology at the University of Sidney, Australia.

Doctors F. W. Dean and L. G. Howard, of Council Bluffs, have formed a partnership. Dr. L. L. Henninger has retired from the firm.

Dr. Aaron S. Green and Dr. Louis D. Green, of San Francisco, announce the removal of their offices from the Shreve Building to the Green Building.

Doctors H. M. and J. W. Thompson, of Pueblo, have opened an office in the Bank of Italy Building, Los Angeles. Dr. H. M. Thompson will go to Los Angeles while Dr. J. W. Thompson will have charge of the office in Pueblo.

Dr. Harry Gradle of Chicago was the speaker of the evening at the first scientific session of the Brooklyn Ophthalmological Society, October 19th. His subject was "Clinical Demonstration of the Optics and Use of the Gullstrand Slit Lamp."

SOCIETIES.

The next International Ophthalmologic Congress will be held in London in 1925.

At the annual meeting of the Ophthalmological Club of Cincinnati, held recently under the presidency of Dr. Robert Sattler, the following officers were elected for the ensuing year: President, Dr. Derrick T. Vail; secretary, Dr. Robert C. Heflebower, and treasurer, Dr. W. E. Schenck. Dr. Martin H. Fischer was the guest of honor.

MISCELLANEOUS.

The new building of the Eye, Ear, Nose and Throat Hospital of New Orleans has been opened.

A few years ago there were 8,798 cases of trachoma among the school children of New York City. At the present time there are only 345 cases.

At a recent meeting of the New York State Board of Charities, the incorporators of the Community Eye and Ear Infirmary, who have applied for a license to establish a dispensary at 283 East Broadway, found opposition to the plan by the Medical Society of the County of New York, the Beth Israel Hospital and the Good Samaritan East Side Dispensary, on the ground that another dispensary is not needed on the East Side.

The comité d'aide de l'Union des aveugles de guerre, Paris, is requesting American ophthalmologists, oculists and other practitioners to contribute and to enlist the interest of their friends in behalf of the French Union des aveugles de guerre. The union faces the problem of continuing at 25 rue Ballu, Paris, its center for blinded soldiers, which supplies recreation and a Braille library, buys raw material, makes sales and finds employment and offers lodging and care in urgent cases. Cooperation with the American profession is secured thru Dr. de Lapersonne, chief of the eye clinic at the Hotel Dieu, Drs. de Schweinitz, Wilmer, McReynolds, Parker and Merrill. Dr. Theodore C. Merrill, the American delegate for the union, will receive contributions. Address: 10 bis rue Herran, Paris, XVIe, France. (Jour. of A. M. A., Dec. 23, 1922.)

Current Literature

These are the titles of papers bearing on ophthalmology received in the past month. Later most of them will be noticed in Ophthalmic Literature. They are given in English, some modified to indicate more clearly their subjects. They are grouped under appropriate heads, and in each group arranged alphabetically, usually by the author's name in **heavy-face type.** The abbreviations mean: (Ill.) illustrated; (Pl.) plates; (Col. Pl.) colored plates. Abst. shows it is an abstract of the original article. (Bibl.) means bibliography and (Dis.) discussion published with a paper. Under repeated titles are given additional references to papers already noticed. To secure early mention, copies of papers or reprints should be sent to 217 Imperial Building, Denver, Colorado.

BOOKS.

Ginestous, E. Ophtalmologie Infantile. 920 pages, 98 illustration, Paris, 1922, G. Doin. Clin. Opht., 1922, v. 26, p. 479.

Morax, V. Précis d'Ophtalmologie. Third edition. Brit. Jour. Ophth., 1922, v. 6, p. 574.

DIAGNOSIS.

Barath, E. Epinephrin mydriasis in diagnosis. Med. Klin., 1922, v. 18, p. 1182. Abst. J. A. M. A., 1922, v. 79, p. 2126.

Hartridge, H., and **Owen, H. B.** Test types. (4 tables.) Brit. Jour. Ophth., 1922, v. 6, pp. 543-549.

Koby, F. E. Optical properties of Gullstrand lamp. (5 ill. bibl.) Arch. d'Opht., 1922, v. 39, pp. 662-673.

Sabat, B. Roentgen rays in ophthalmology. Polska Gaz. Lek., 1922, v. 1, p. 742. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-476).

Schousboe, M. F. Examination of fundus in high myopia. Clin. Opht., 1922, v. 26, p. 486. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-516).

Steindorff, K. Technic of testing vision. Deut. med. Woch., 1922, v. 48, p. 1351.
Testing eye tension and pupil reactions. Deut. med. Woch., 1922, v. 48, p. 1289.

Vogt's course on microscopy of living eye. Brit. Jour. Ophth., 1922, v. 6, p. 574.

Repeated title. **Lemoine** and **Valois.** (A. J. O., 1922, v. 5, p. 988.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-470).

THERAPEUTICS.

Abelsdorff and **Steindorff.** Ophthalmologic technic. Compresses. Deut. med. Woch., 1922, v. 48, p. 1143. Abst. Intern Med. and Surg. Survey, 1922, v. 4, (8a-477).

Bourgeois, A. Care in use of solutions in eyes by patients. Arch. d'Opht., 1922, v. 39, p. 701.

Bruno, D. Iridal in ocular therapy. Gior. di Ocul., 1922, v. 3, p. 136. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-479).

Bussy. Subconjunctival therapeutics. Lyon Méd., 1922, v. 131, p. 755. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-505).

Fernando, A. S. Milk injections in ocular inflammations. Philippine Islands Med. Assn. Jour., 1922, v. 2, p. 217.

Fernando, A. S., and **Nicolas, F.** Milk injections in ocular inflammations. Philippine Islands Med. Assn. Jour., 1922, v. 2, p. 218.

Gifford, S. R. Salicylat therapy. (bibl.) A. J. O., 1922, v. 5, pp. 948-952.

Morrison, H. F. Relation of anaphylaxis to eye, ear, nose and throat practice. Nebr. State Med. Jour., 1922, v. 7, pp. 416-421.

Tewfik, M. Milk injections. A. J. O., 1922, v. 5, p. 975.

Tobias, G. Intracutaneous reaction with foreign proteins in ophthalmology. Zeit. f. d. ges. exper. Med., 1922, v. 29, p. 251. Abst. Intern. Med. and Surg. Survey, 1922, v 4, (8a-506).

Repeated titles. **Oguchi.** (A. J. O., 1922, v. 5, p. 933.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-473). **Schanz.** (A. J. O., 1922, v. 5, p. 988.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-503). **Sgrosso.** (A. J. O., 1922, v. 5, p. 690.) A. J. O., 1922, v. 5, p. 980.

OPERATIONS.

Carrasco, M. G. Vaccine therapy in ocular operations. España Oft., 1922, v. 7, pp. 121-130.

Dickson, R. M. Butyn. Brit. Jour. Ophth., 1922, v. 6, p. 575.

Treutler. A new lance. Arch. f. Augenh., 1922, v. 91, p. 34. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-501).

Repeated title. **Hessberg.** A. J. O., 1922, v. 5, p. 988.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-546).

REFRACTION.

Gonzalez, J. de J. Refraction in keratoconus. Anales de la Soc. Mex. de Oft. y Oto. Rino. Larin., 1922, pp. 146-148.

Mendoza, R. New methods of refraction Anales de la Soc. Mex. Oft. y Oto. Rino. Larin., 1922, pp. 154-157.

OCULAR MOVEMENTS.

Eckert, A. Nystagmus by caloric irritation. Zeit. f. Hals-Nasen u. Ohrenh., 1922, v. 2, p. 165. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-495).

Tomkinson, J. G. Alopecia areata and strabismus. Brit. Med. Jour., 1922, Nov. 18, p. 1001.

Repeated titles. **Abelsdorff** and **Steindorff.** (A. J. O., 1922, v. 5, p. 989.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-524). **Lagrange and Pesme.** (A. J. O., 1922, v. 5, p. 989.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-525) **Marin Amat.** (A. J. O., 1922, v. 5, p. 989.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-526). **Mazzei.** (O. L., 1921, v. 17, p. 544.) A. J. O., 1922, v. 5, p. 985. **Zamora.** (A. J. O., 1922, v. 5, p. 989.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-520).

CONJUNCTIVA.

Ariot. Cytology of trachoma. Arch. d'Opht., 1922, v. 39, p. 687.

Aubaret. Prophylaxis of trachoma. Arch. d'Opht., 1922, v. 39, p. 688.

Baurmann, M. Plasmoma of conjunctiva. (2 ill.) Graefe's Arch. f. Ophth., 1922, v. 109, pp. 236-252.

Bull, L. B. Habronemic conjunctivitis producing "bung eye." Med. Jour. Australia, 1922, Oct. 28, p. 499.

Darier, A. Contagion of trachoma in wrestlers. Clin. Opht., 1922, v. 26, pp. 603-606.

Kamel, M. Silver nitrat solutions for conjunctival disease. A. J. O., 1922, v. 5, p. 977.

Lagrange, H. Catarrhal conjunctivitis, medical anaphylaxis and endocrin disorders. Arch. d'Opht., 1922, v. 39, pp. 679-685.

Peyrelongue. Treatment of spring catarrh benefited by intravenous injections of salt, (bibl.) Arch. d'Opht., 1922, v. 39, pp. 653-661.

Resch, K. L. Bacteriologic experiments with bactericidal treatment of Koch-Weeks conjunctivitis. Arch. f. Augenh., 1922, v. 91, p. 52. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-502).

Rodriguez, D. Antidiplobacillary vaccine therapy. España Oft., 1922, v. 7, pp. 130-135.

Sedan, J. Hospital treatment of trachoma. Arch. d'Opht., 1922, v. 39, p. 687.

Trachoma and arsenobenzol. Marseille Méd., 1922, v. 59, p. 863. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-539).

Sobhy Bey, M. Pseudomembranous conjunctivitis treated with antidiphtheritic serum. A. J. O., 1922, v. 5, p. 975.

Parinaud's conjunctivitis. A. J. O., 1922, v. 5, p. 977.

Stevens, A. M., and Johnson, F. C. Eruptive fever with stomatitis and ophthalmia. Amer. Jour. Dis. Child., 1922, v. 24, pp. 526-534.

Stitelet. Trachoma in military service. Arch. d'Opht., 1922, v. 39, p. 686.

Strebel. Diagnosis and treatment of spring catarrh. Schweiz. med. Woch., 1922, Oct. 5. Abst. Clin. Opht., 1922, v. 26, p. 626.

Spring conjunctivitis and hay fever. Schweiz. med. Woch., 1922, v. 52, p. 981. Abst. J. A. M. A., 1922, v. 79, p. 1963.

Truc. Trachoma in Montpellier. Arch. d'Opht., 1922, v. 39, p. 689.

Zaky, M. Scrofula and phlyctenular conjunctivitis. A. J. O., 1922, v. 5, p. 979.

Repeated title. Fernandez.. (A. J. O., 1922, v. 5, p. 989.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-541.) **Oguchi** and **Majima.** (A. J. O., 1922, v. 5, p. 935.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-540).

CORNEA AND SCLERA.

Jack, C. M. Tuberculous sclerokeratitis. J. A. M. A., 1922, v. 79, pp. 1576-1578.

Knapp. P. Disciform keratitis. (bibl.) Rev. Gén. d'Opht., 1922, v. 36, pp. 289-305.

Mariana, G. Keratitis and herpetic meningoencephalitis. Policlinico. (Pract. sect.), 1922, v. 29, p. 1193. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-559).

Mendoza, R. Treatment of keratoconus. Anales de la Soc. Mex. de Oft. y Oto-Rino-Larin., 1922, p. 149.

Moulton, E. C. Infected corneal ulcer. A. J. O., 1922, v. 5, pp. 972-973.

Steindorff, K. Influence of chlorin derivatives on cornea of animals. Graefe's Arch. f. Ophth., 1922, v. 109, p. 252.

Von der Heydt, R. Clinical observations on cornea. A. J. O., 1922, v. 5, pp. 943-946.

Repeated title. **Birch-Hirschfeld.** (O. L., 1921, v. 17, p. 112.) Arch. of Ophth., 1922, v. 51, p. 605. **Duverger** and **Lampert.** (A. J. O., 1922, v. 5, p. 853.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-552.) **Mendoza.** (A. J. O., 1922, v. 5, p. 990.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-551). **Petit.** (A. J. O., 1922, v. 5, p. 990.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-547.) **Zamora.** (A. J. O., 1922, v. 5, p. 990.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-553-554)

ANTERIOR CHAMBER.

Sergent, Perin and Albert. Pupil in tuberculosis. Anales de la Soc. Mex. Oft. Oto-Rino-Larin, 1922, pp. 167-174.

UVEAL TRACT.

Bailliart. Network of veins of face and anterior surface of iris. Soc. d'Opht. de Paris, 1922, July. Ann. d'Ocul., 1922, v. 159, p. 860.

Curschmann. Intermittent heterochromia of iris. Klin. Woch., 1922, v. 1, p. 2271.

Sedan, J. Inflammatory myopia following syphilitic iritis. Marseille Méd., 1922, v. 59, p. 871. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-563).

Sobel. Marked changes in iris. Klin. Woch., 1922, v. 1, p. 2333.

Torres Estrada, A. Double iridocyclitis from tooth abscess. Anales de la Soc. Mex. Oft. Oto-Rino-Larin., 1922, p. 159.

Wolfrum. Structure of anterior surface of iris in man. (15 ill.) Graefe's Arch. f. Ophth., 1922, v. 109, pp. 106-154.

SYMPATHETIC DISEASE.

Guillery, H. Sympathetic inflammation and posterior channel of exit of fluid from eye. Arch. f. Augenh., 1922, v. 91, p. 39. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-591).

Woods, A. C., and **Knapp, A.** Diagnostic and therapeutic use of uveal pigment in injuries of uveal tract and sympathetic ophthalmia. Bull. Johns Hopkins Hospital, 1922, v. 33, pp. 419-425.

GLAUCOMA.

Alonso, A. F. Sclerectomy of Lagrange and Elliot trephining in glaucoma. España Oft., 1922, v. 7, pp. 142-148.

Bonnefon. Physiology of ophthalmotonus. (6 charts.) Ann. d'Ocul., 1922, v. 159, pp. 840-860.

Ellett, E. C. Secondary glaucoma, enucleation. A. J. O., 1922, v. 5, p. 979.

Girgis, A. M. Iridotomy for glaucoma. A. J. O., 1922, v. 5, p. 978.

Gonzalez, J. de J. Glaucomatous tension in senile cataract. Anales de la Soc. Mex. Oft. y Oto-Rino-Larin., 1922, p. 161.

MacCallan, A. F. Primary glaucoma in Egypt. A. J. O., 1922, v. 5, p. 977.

Stransky, H. Fenestrated sclerotomy in simple glaucoma and secretory hypertonia. Arch. f. Augenh., 1922, v. 91, p. 95. Abst. Intern Med. and Surg. Survey, 1922, v. 4, (8a-586).

Repeated title. **Hagen.** (A. J. O., 1922, v. 5, p. 516.) A. J. O., 1922, v. 5, p. 984. **Seidel.** (A. J. O., 1922, v. 5, p. 936.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-561)

CRYSTALLINE LENS.

Castresana. Autogenous vaccines in cataract operations. Clin. Opht., 1922, v. 26, pp. 606-614.

Denti, A. V. Incident during cataract operation. Gior. di Ocul., 1922, v. 3, p. 134. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-575).

Ellett, E. C. Sequels of cataract extraction. A. J. O., 1922, v. 5, p. 979.

Farina, F. Chromatic sensibility in patients with senile cataract. Gior. di Ocul., 1922, v. 3, p. 125. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-571).

Gonzalez, J. de J. Spontaneous rupture of Morgagnian cataract. Anales de la Soc. Mex. de Oft. y Oto-Rino-Larin., Jan.-Oct., 1922, pp. 143-145.

Hardy, W. F. Cataract procedures. A. J. O., 1922, v. 5, pp. 961-967.

Heflebower, R. C. Cataract operation. Eclectic Med. Jour., 1922, v. 82, p. 586.

Hirschberg, J. Cataract in elderly patients. Deut. med. Woch., 1922, v. 48, p. 1271.

Horvath, B. Opacities of lens caused by brass particles inside eye. Orvosi Hetil., 1922, v. 66, p. 349. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-582).

Hughes, W. F. Modification of Barraquer erisiphake. Trans Indiana Acad. Ophth. and Oto-Laryn, 1922, p. 4.

Lopez, C. J. and **Ribon, V.** Extraction of cataract in case of ozena. Siglo Med., 1922, v. 70, p. 249. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-574).

Pulleine, R. H. Polar cataract. Med. Jour. Australia, 1922, Nov. 11, p. 570.

Ruby, F. M. Hereditary subluxation of lens. Trans. Indiana Acad. Ophth. and Oto-Laryn., 1922, pp. 8-11.

Vogt, A. Slit lamp microscopy of traumatic and complicated cataract. (50 ill.) Graefe's Arch. f. Ophth., 1922, v. 109, pp. 154-205.

Wick, W. Cataract in glass blowers. (1 ill.) Graefe's Arch. f. Ophth., 1922, v. 109, pp. 224-236.

Repeated titles. **Beauvieux.** (A. J. O., 1922, v. 5, p. 991.) Brit. Jour. Ophth., 1922, v. 6, p. 569. **Marbaix.** (A. J. O., 1922, v. 5, p. 992.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-578). **St. Martin, de.** (O. L., 1921, v. 17, p. 551.) Brit. Jour. Ophth., 1922, v. 6, p. 565. **Schmitt.**. (A. J. O., 1922, v. 5, p. 937.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-570). **Seefelder.** (A. J. O., 1922, v. 5, p. 937.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-569). **Van Lint.** (A. J. O., 1922, v. 5, p. 992.) Intern. Med. and Surg. Survey, 1922, (8a-579).

THE VITREOUS

Scarlett, H. W. Opaque canal of Cloquet with persistent hyaloid artery. (1 col. pl. bibl.) A. J. O., 1922, v. 5, pp. 941-943.

Repeated titles. **Jeandelize, Bretagne** and **Richard.** (A. J. O., 1922, v. 5, p. 992.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-595). **Tscherning.** (A. J. O., 1922, v. 5, p. 992.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-597).

THE RETINA.

Bailliart, P. Retinal circulation in intracranial hypertension. Ann. d'Ocul., 1922, v. 159, pp. 785-790.

Carr, A. D. Enlargement of sella turcica with chorioretinitis. Jour. Missouri State Med., 1922, v. 19, p. 521.

Cobb, P. W. Individual variations in retinal sensitivity with ophthalmologic findings. Jour. Exper. Psychol., 1922, v. 5, p. 227.

Eber, S. I. Autoophthalmoscopy. Subjective examination of retina. A. J. O., 1922, v. 5, pp. 973-974.

Gros, H. Ophthalmic diagnosis of diabetic lipemia. Clin. Opht., 1922, v. 26, p. 490. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-472).

Moore, F. Retinitis of arteriosclerosis. Lancet, 1922, Dec. 9, p. 1223.

Onfray. Preretinal hemorrhage in pregnancy. Soc. d'Opht. de Paris, 1922, July. Ann. d'Ocul., 1922, v. 159, p. 860.

Percival, A. S. Light sense with reference to navigation. Brit. Med. Jour. 1922, Dec. 2, p. 1096.

Raia, V. L. Retinitis proliferans of syphilitic and diabetic origin. (2 ill.) A. J. O., 1922, v. 5, pp. 946-948.

Riad, M. Appearance of fundus in ankylostoma infection. A. J. O., 1922, v. 5, p. 976.

Schall, E. Detachment of retina with tuberculosis. (3 ill.) Graefe's Arch. f. Ophth., 1922, v. 109, pp. 205-221.

Shaw, H. B. Vascular and other changes in retina in arteriosclerosis and renal disease. Med. Press, 1922, v. 114, pp. 469-472. Lancet, 1922, Dec. 9, p. 1222.

Repeated titles. **Comberg.** (A. J. O., 1922, v. 5, p. 937.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-603). **Zamora.** (A. J. O., 1922, v. 5, p. 992.) Intern Med. and Surg. Survey, 1922, v. 4, (8a-608).

THE OPTIC NERVE.

Garcia Mansilla. Papillitis cured by enucleation of exciting eye. Espana Oft., 1922, v. 7, p. 156.

Optic neuritis. España Oft., 1922, v. 7, p. 151.

Gifford, S. R. Treatment of luetic optic atrophy. Nebr. State Med. Jour., 1922, v. 7, pp. 408-413.

Hess, C. v. Fibers in optic nerve. Med. Klin., 1922, v. 18, p. 1214.

Iconomopoulos, A. Point of view of ophthalmologists concerning operation for papillary stasis. Ann. d'Ocul., 1922, v. 159, pp. 790-825.

Liebrecht. Origin of choked disc. Arch. f. Augenh., 1922, v. 91, p. 84. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-613).

MacCallan, A. F. Optic atrophy. A. J. O., 1922, v. 5, p. 976.

Szily, A. v. Morphogenesis of optic nerve entrance and its relation to primary form of papilla in vertebrates. Graefe's Arch. f. Ophth., 1922, v. 109, pp. 3-105.

Repeated titles. **Chaillous.** (A. J. O., 1922, v. 5, p. 993.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-614.) **Garcia Mansilla.** (A. J. O., 1922, v. 5, p. 993.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-612). **Lagrange.** (A. J. O., 1922, v. 5, p. 993.) Brit. Jour. Ophth., 1922, v. 6, p. 568.

VISUAL TRACTS AND CENTERS.

Calhoun, F. P. Ocular manifestations of hypophyseal syphilis. (1 fig. bibl.) A. J. O., 1922, v. 5, pp. 952-955.

Mella, H. Thrombotic cortical amaurosis. Jour. Nerv. and Ment. Dis., 1922, v. 56, pp. 563-567.

Monthus and Drecourt. Amaurosis after spinal anesthesia. Soc. d'Opht. de Paris, 1922, July. Ann. d'Ocul., 1922, v. 159, p. 861.

Pascheff, C. Injury as cause of diabetes insipidus with bitemporal hemianopia. (5 figs.) Brit. Jour. Ophth., 1922, v. 6, pp. 549-554.

Sachs, E. Relation between central and peripheral involvement of cranial nerves. Amer. Jour. Med. Sci., 1922, v. 154, pp. 727-742.

Vacher and Denis. Hypophyseal syndrome treated with radiotherapy. (2 ill.) Arch. d'Opht., 1922, v. 39, pp. 674-678.

Repeated titles. **Kuemmel.** (A. J. O., 1922, v. 5, p. 993.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-604). **Marin Amat.** (A. J. O., 1922, v. 5, p. 993.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-609).

COLOR VISION.

Coleman, W. M. Red fatigue. Brit. Med. Jour., 1922, Dec. 2, p. 1146.

Morax and Bollack. Hemiachromatopsia with chiasmal lesion. Soc. d'Opht. de Paris, 1922, July. Ann. d'Ocul., 1922, v. 159, p. 861.

Ostwald, W. Development of theory of color since Newton. Deut. med. Woch., 1922, v. 48, p. 1237. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-466).

Repeated title. **Schanz.** (A. J. O., 1922, v. 5, p. 993). Intern. Med. and Surg. Survey, 1922, v. 4, (8a-465).

DISEASES OF THE EYEBALL.

Alvarez, A. P. Spontaneous rupture of globe. Arch. d'Opht., 1922, v. 39, p. 701.

Meissner, M. Thrombosis of cavernous sinus and atrophy of globe. Wien. med. Woch., 1922, No. 44, p. 1790.

Velez. Enucleation of globe. (dis.) Anales de la Soc. Mex. Oft. y Oto-Rino-Larin., 1922, p. 164.

THE LACRIMAL APPARATUS.

Barnhill, J. F. Mosher-Toti operation on lacrimal sac. Trans. Indiana Soc. Ophth. and Oto-Laryn., 1922, pp. 18-23.

Benjamins, C. E. and **Van Romunde, L. H.** Plastic operations on lacrimal canal. (2 ill.) Graefe's Arch. f. Ophth., 1922, v. 109, pp. 221-224.

Calderon, J. M. Treatment of dacryocystitis. Anales de la Soc. Med. Oft. y Oto-Rino-Larin., 1922, p. 151.

Ellett, E. C. Sac removed for dacryocystitis. A. J. O., 1922, v. 5, p. 980.

Fava. Streptothricosis of lacrimal sac. España Oft., 1922, v. 7, p. 136.

Jacquin. Lacrimal trachoma. Arch. d'Opht., 1922, v. 39, p. 687.

Pedraja. Treatment of dacryocystitis. España Oft., 1922, v. 7, p. 136.

Rowland, W. D. Defects in nasolacrimal passageways. Jour. Ophth. Oto-Laryn., 1922, v. 26, pp. 439-443.

Santos Fernandez, J. Affections of lacrimal apparatus. España Oft., 1922, v. 7, p. 135.

Repeated title. **Dupuy-Dutemps** and **Bourguet.** (A. J. O., 1922, v. 5, p. 79.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-529).

DISEASES OF THE LIDS.

Campos, E. Hysteric ptosis. (8 ill.) Brazil Med., 1922, v. 36, pp. 345-349.

Fakhry. Unilateral congenital ptosis. A. J. O., 1922, v. 5, p. 978.

Lapersonne, F. de and **Casteran.** Palpebral furunculosis and vaccines. Arch. d'Opht., 1922, v. 39, pp. 641-652.

Sobhy Bey, M. Palpebral sporotrichosis. A. J. O., 1922, v. 5, p. 978.

Repeated titles. **Braun.** (A. J. O., 1922, v. 5, p. 518.) A. J. O., 1922, v. 5, p. 985. **Hessberg.** (A. J. O., 1922, v. 5, p. 518.) A. J. O., 1922, v. 5, p. 985. **Moutinho.** (A. J. O., 1922, v. 5, p. 994.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-533). **Rubio.** (A. J. O., 1922, v. 5, p. 994.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-531).

DISEASES OF THE ORBIT.

Dolbey, R. B. Ethmoiditis simulating orbital tumor. A. J. O., 1922, v. 5, p. 976.

Jacques, P. and **Gamaleia, N.** Frontal mucocele. Ann. d. Mal de l'Oreille, du Larynx., 1922, v. 41, p. 761. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-498).

Margarucci, O. and **Giannelli, A.** Sphygmography in pulsating exophthalmos. Policlinico, 1922, v. 29, p. 496. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-494).

Nishioka, M. Ovarian exophthalmos. Japan Med. World, 1922, Nov. 15, p. 326.

Rollet. Hemorrhagic mucocele of orbit. Arch. d'Opht., 1922, v. 39, p. 700.

Tewfik, M. Arteriovenous aneurism of orbit. A. J. O., 1922, v. 5, p. 978.

Wissmann, R. and **Schulz, A.** Intermittent exophthalmos. Arch. f. Augenh., 1922, v. 91, p. 11. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-493).

Repeated title. **Zirm.** (A. J. O., 1922, v. 5, p. 167.) A. J. O., 1922, v. 5, p. 986.

INJURIES.

McPherson, J. B. Injuries to eye. Nebr. State Med. Jour., 1922, v. 7, p. 434.

Migally, A. Perforation of cornea by piece of egg shell. A. J. O., 1922, v. 5, p. 975.

Seddik, Z. Foreign bodies in eyeball. A. J. O., 1922, v. 5, p. 975.

Stein, V. Eye injuries especially of cornea by foreign body. Prakticky Lek., 1922, v. 2, p. 159. Abst. Intern Med. and Surg. Survey, 1922, v. 4, (8a-550).

Wood, D. J. Injuries and common diseases of eye. South African Med. Rec., 1922, v. 20, p. 390.

Repeated title. **Fernandez.** (A. J. O., 1922, v. 5, p. 994.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-484).

TUMORS.

Abu Seif, H. Intraorbital tumor. A. J. O., 1922, v. 5, p. 979.

Adams, C. J. Intraocular malignant tumors in young children. A. J. O., 1922, v. 5, pp. 967-969.

Aubaret and **Sodan, J.** Extension of epithelioma on cornea. (5 ill. bibl.) Ann. d'Ocul., 1922, v. 159, pp. 825-840.

Cuevas Pulida. Melanochromia of sclera of congenital origin. España Oft., 1922, v. 7, p. 149.

Ellett, E. C. Tumor of retina. A. J. O., 1922, v. 5, p. 979.

Fialho, A. Sarcoma of choroid. (3 ill.) Brazil Med., 1922, v. 36, pp. 329-331.

Judd, F. H. Rare form of subconjunctival granuloma. China Med. Jour., 1922, v. 36, p. 397.

Licsko, A. Malignant tumors of limbus. Arch. f. Augenh., 1922, v. 91, p. 1. Abst. Intern Med. and Surg. Survey, 1922, v. 4, (8a-549).

Marin Amat. Glioma of optic nerve and retina. España Oft., 1922, v. 7, p. 153.

Marx, E. Glioma of retina. Nederl. Tijdsch. v. Geneesk., 1922, v. 2, p. 683. Abst. J. A. M. A., 1922, v. 79, p. 2045.

Michail, D. Mechanism of intraocular proliferation of epibulbar epitheliomas. Cluj ul Med., 1922, v. 3, p. 222. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-490).

Neame, H. Ocular sarcoma involving brain and spinal cord. (bibl.) Brit. Jour. Ophth., 1922, v. 6, pp. 537-542.

Riad, M. Lymphangiomata of face and scalp. A. J. O., 1922, v. 5, p. 977.

Sobhy Bey, M. Adenoma of meibomian glands. A. J. O., 1922, v. 5, p. 978.

Repeated title. **Camison.** (A. J. O., 1922, v. 5, p. 994.) Intern Med. and Surg. Survey, 1922, v. 4, (8a-544). **Lopez, Ribon** and **Chavarria.** (A. J. O., 1922, v. 5, p. 776.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-543).

OCULAR PARASITES.

Sobhy Bey, M. Filarial cyst of orbit. A. J. O., 1922, v. 5, p. 976.

Repeated title. **Villard.** (A. J. O., 1922, v. 5, p. 995.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-542).

GENERAL AND EXTRAOCULAR DISEASES.

Albin, W. L. Eye and its relation to internal medicine. Nebr. State Med. Jour., 1922, v. 7, pp. 424-428.

Herrenschwand, F. Efficacy of Deycke-Much partial antigens in tuberculosis of eye. Arch. f. Augenh, 1922, v. 91, p. 58. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-481).

Husik, D. N. Total bilateral blindness in boy of 7 cured by ethmoid operation. Laryngoscope, 1922, v. 32, p. 874-877.

Kiep, W. H. Ocular complications in malaria. A. J. O., 1922, v. 5, p. 977.

Ramsey, A. M. Clinical significance of failing sight. Glasgow Med. Jour., 1922, v. 16, pp. 289-317.

Sedan, J. Ophthalmoplegic migrain of malarial origin. Marseille Méd., 1922, v. 59, p. 867. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-482).

Soederbergh, G. Corneal changes in pseudosclerosis. Acta. Med. Scand., 1922, v. 56, pp. 604-618.

Werdenberg, E. Ocular tuberculosis. Rev. Gen. d'Opht., 1922, v. 36, pp. 343-356.

Whitehead, A. L. Ocular tuberculosis. (bibl.) Brit. Jour. Ophth., 1922, v. 6, pp. 529-537.

Repeated titles. **Blatt.** (A. J. O., 1922, v. 5, p. 940.) Intern Med. and Surg. Survey, 1922, v. 4, (8a-568). **Delord.** (A. J. O., 1922, v. 5, p. 995.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-523). **Gardel.** (A. J. O., 1922, v. 5, p. 995.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-480). **Souques.** (A. J. O., 1922, v. 5, p. 776.) A. J. O., 1922, v. 5, p. 984. **Weekers.** (A. J. O., 1922, v. 5, p. 995.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-489).

COMPARATIVE OPHTHALMOLOGY.

Hess, C. v. Visual qualities of insects and crabs. Deut. med. Woch., 1922, v. 48, p. 1238. Abst. Intern. Med. and Surg. Survey, 1922, v. 4, (8a-504).

VISUAL HYGIENE AND PROPHYLAXIS.

Causes and prevention of blindness. Brit. Med. Jour., 1922, Nov. 25, p. 1037.

Economic value of clean windows and lighting fixtures. New York State Dept. of Labor Bull. No. 112, June, 1922, p. 15. Abst. Jour. Indust. Hyg., 1922, v. 4, p. 136.

Repeated title. **Ribas Valero, R.** (A. J. O., 1922, v. 5, p. 996.) Intern. Med. and Surg. Survey, 1922, v. 4, (8a-467).

OPHTHALMIC SOCIOLOGY.

Defective vision and motor accidents. Lancet, 1922, Nov. 25, p. 1135.

Llewellyn, T. L. Miners' nystagmus from point of view of workmen's compensation act. (bibl.) Jour. Indust. Hyg., 1922, v. 4, pp. 335-345.

MacCallan, A. F. Blindness in Egypt. A. J. O., 1922, v. 5, p. 975.

Report of sight testing by opticians Council of British Ophthalmologists. Brit. Jour. Ophth., 1922, v. 6, pp. 554-559.

Scotland and the blind persons act. Lancet, 1922, Dec. 9, p. 1256.

Sight testing by opticians. Brit. Med. Jour., 1922, Dec. 2, p. 1084.

Status of sight testing opticians. Brit. Jour. Ophth., 1922, v. 6, pp. 560-561.

HISTORY, EDUCATION AND INSTITUTIONS.

Albertotti, G. Artificial anatomic eye after model of Verle. Abst. Ann. di Ottal. e Clin. Ocul., 1922, v. 50, p. 466.

Fernando, A. S. Ophthalmology in Philippines. A. J. O., 1922, v. 5, p. 983.

Fialho, A. Foundation of ophthalmologic society. Brazil Med., 1922, v. 2, p. 129.

Jackson, E. Closing volume. A. J. O., 1922, v. 5, p. 982.

Ophthalmic Year Book. A. J. O., 1922, v. 5, pp. 981-982.

Rasheed Bey, A. F. El. European clinics. A. J. O., 1922, v. 5, p. 975.

Santos Fernandez, Dr. D. J. (1 ill.) España Oft., 1922, v. 7, p. 141.

Welton, C. B. Impressions of the Cuban ophthalmologist. A. J. O., 1922, v. 5, pp. 970-972.